Pit and Quarry

SAND-GRAVEL-STONE
CEMENT-LIME-GYPSUM

June 15, 1926

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

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Vol. 12 CHICAGO, ILL., JUNE 15, 1926 No. 6

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Pit and Quarry

Vol. 12 Chicago, Ill., June 15, 1926 No. 6

You'll Be Surprised!

We hope you will be pleased when you receive your copy of the next issue of PIT and QUARRY, July 7th. It will be the first issue of the large 12″x9″ size, and you will be surprised at the improvement. You will benefit by some new features which the larger page makes possible.

Already hundreds of readers and advertisers have expressed their approval of the idea.

Watch for your copy of the July 7th issue and—after you have examined or read it—let us know how well and just why you like it. Will you?

Economy at All Times

ECONOMY is more easily practiced when we are in the throes of business depression than when we are enjoying prosperity. This is true with the individual in his personal financial program and with the business organization. The effect of prosperity is to bring about increased waste and reckless expenditure. If money is easily acquired, it is readily spent; if business is good, everyone in the organization responds to a spirit of financial ease which permeates the plant. Requisitions increase in number and size; material is wasted; an easing up on the tension is apparent all along the line. On the other hand, when it is known that business is unstable, that times are hard, it is easy to carry through a rigid program of economy. All members of the organization from manager or superintendent to errand boy join in an organized effort to bring about a successful drive for economy. Of course, the motive is self-preservation. If jobs are at stake, fear lurks in the background, furnishing ample incentive for cooperation. When the danger passes, fear fades away and a spirit of indolence and indifference sometimes pervades the group. No one would prefer business depression and hard times to prosperity. There are, however, some valuable lessons learned during those troubleous times which should not be forgotten nor discarded when the need for them is less urgent.

The executive who successfully retains a practicable program of economy when business is good has solved an important problem of management. To do so he must be exceedingly skillful. The need for economy is not apparent to the men; the practice of economy is not always pleasant. He must make it a habit. He must convince his employees that economy is necessary both for the present and for the future; that it is in the long run advantageous to every one in the organization; and that it does not increase the burdens for any one. Extravagant buying, undue waste of time and material, unwarranted labor turnover, carelessness in the use of tools, unnecessary destruction of expensive machinery, discarding machinery which could be repaired—these are the problems which confront the executive who attempts to solve this problem of economy during "good times." If he does not check such

wasteful practices and devise a method of economy that will function continuously and satisfactorily, he faces the danger of being swept under when any adverse current of the business cycle comes his way.

A study of the business cycle convinces the executive that he must be ready for any emergency. When the weather is fairest, he must be glancing about for the ominous cloud. The business cycle is a modern phenomenon which must be reckoned with. Prices rise and fall; production increases and decreases; orders accumulate beyond capacity and suddenly disappear. Depressions give place to business booms from which come crises which in turn lead to depressions. Lean years follow fat years now as in bygone centuries. A vast system of production is built upon the estimated strength of the market. Contracts are good just as long as the structure is strong. When one man fails to meet an obligation, others are affected. When the system of contracts breaks down, a crisis comes. Dealers are overstocked; establishments are over-capitalized. Then comes a recovery of business from the period of depression. There is some slack or surplus, not only in the supply of credit, but in the supplies of labor, of materials, and of the instruments of production as well. With the expansion of business, shortages appear in these different fields as well as in the field of credit. Increased costs require that a rising price level of profits be maintained.

A careful investigation of the regular occurrence of these periods of depression and prosperity which constitute the business cycle will reveal the character of the difficulties and temptations which business men must face in a period of active business. Failure to consider the cyclical nature of prices and business activity in one period accounts for difficulties encountered in subsequent periods of deflation and depression. Far sighted executives have become aware of the value of budgets and of other systems of financial and operating control. They are recognizing the value of technological research, of labor-saving machinery, and of plans for scientific selection, training and remunerating their employees. They are endeavoring to eliminate all unnecessary cost elements. They are aware of the danger of falling into careless methods during periods of prosperity and of suffering proportionately when the period of depression comes.

There are many phases of this subject of a program of economy. All operating problems should be considered with regard to possible periods of prosperity and of depression. Building up a structure along lines of economy requires keen foresight and rare judgment. To secure the cooperation and good will of the employees is one of the most practical achievements of an executive. To convince them that skill and economy are essential to successful operation is an important part of his work. To establish a routine which is efficient, satisfactory and permanent is a necessity if maximum production is to be secured. Those employees who are inclined to relax during the period of prosperity should be convinced that such a policy is as detrimental to themselves as to the company. Those who become careless or reckless in their use of equipment should be trained into habits which will be valuable to themselves and to their employer.

In every plant there are possibilities for greater economy; there are various kinds of wastes that can be studied and either cut down or eliminated. There is waste from labor turnover, from labor conflicts, from over-production and less than capacity production, from excessive seasonal operation, from lack of standardization, from lack of skill in management. There is waste due to failure to make proper use of the time and energy of the men; there is waste from failure to use proper equipment, up-to-date machinery and new processes in production. There is waste due to failure to have duties specifically outlined and authority properly delegated.

To secure economy in a plant requires both cooperative and individual effort. Each individual—plant executive and worker—must discover opportunities for improvement and assume responsibility for the performance of his own task. The responsibility, however, for any condition of waste or the absence of a reasonable program of economy rests in the last analysis with the chief executive of each company. While it is important that they devote considerable attention to directing general policies, they cannot be relieved from their responsibility in watching all details of extravagance which develop in their business.

An Impressive Labor Saving Quarry Operating in Pennsylvania

By F. A. Westbrook

MUCH of the limestone produced in Pennsylvania is not burned, but sold to the steel companies for flux. It is also quarried independently and sold to portland cement producers. The Calcite Quarry Company of Meyerstown, Pa., disposes of almost all of its production, amounting to 1500 long tons per day, in this way. The Company operates no kilns and sells only small quantities of stone for road work.

The operation is carried on by means of up-to-date methods in regard to the use of labor saving machinery. In fact, this is the case to an unusual degree for a limestone quarry. Manual handling of the stone has been entirely eliminated. In addition Mr. Patterson, the manager, and Mr. O'Neill, the superintendent, have developed several practical ideas of their own for labor saving, which will be explained.

The quarry is at present being worked at four points. Stone is usually taken out in 25-foot benches, although one of the working faces is slightly over 50 feet. As the good stone is in a vein of uniform quality 300 feet wide, it is possible to pick it up and load it on to cars by means of power shovels. There are four Marion steam shovels in the pit and another at the surface equipped with a Page drag line scraper bucket for stripping. They are all of the caterpiller type except one.

It is a significant and interesting fact that these shovels were in continuous use for about four years. At the end of that time they were given a complete overhauling and it is expected that they are good for another four years. In being overhauled the cabs were rebuilt and special provision was made for ventilation at the top and around the smoke stack.

The fact that shovels are used at the working faces of the quarry has led to a practical labor-saving procedure in regard to blasting. Instead of cleaning up all loose stone before shooting, exactly the reverse is done. The blasts are fired with a heavy blanket of loose rock against the faces. This does not interfere with breaking up the stone but it does prevent it from being blown all over a considerable portion of the quarry. It is therefore not necessary to remove the tracks every time there is a blast, nor to move the shovel any great distance. As soon as the shot has been fired shovel loading may be resumed without loss of time for replacing tracks or clearing up material scattered by the blast. The blanket of loose stone with the drill at work 20 feet back from the edge of the solid rock and the shovel at work on the other side is shown in one of the illustrations. The method of blasting is alluded to as "blanket shooting."

The drilling is done with electrically-operated Clipper drills made by the

Airplane View of Quarries

Chute and Housing For Grizzlies

Loomis Machine Company. The holes are made about three feet deeper than the face of the bench, twenty feet back and fifteen feet apart. An ingenious device, shown in one of the illustrations is used to pull out the iron pipe casings from the drill holes. It is the same thing used by circuses to pull out the heavy tent pegs and it was from this hint that Mr. O'Neill conceived the idea in connection with the casings. The device consists of a pair of small, strong wheels and a long timber, one end of which is equipped with a chain and which projects over the axle only a short distance. The chain is placed around the casing and the long timber is used as a lever, the axle of the wheels being its fulcrum. Six-inch scrap pipe is used for the casings. Blasting takes place about every two weeks. Atlas 40 per cent dynamite is used.

At each point where a shovel is in operation there is a man with an Ingersoll-Rand BCR430 jackhammer to break up pieces which are too large for the crushing machinery. As a good deal of night work is done all the shovels are equipped with Prestolite searchlights and provision has been made for flood lighting the whole quarry and the buildings. Last summer the plant was operated twenty-four hours a day for several months. The stone is loaded by the shovels into home made end-dump cars. They are equipped for dumping from either end so that there need be no difficulty in having them turned in any particular direction for discharging.

Five gasoline locomotives are provided for hauling the cars. Of these, there are two 8-ton Plymouth, two 4-ton Whitcomb and one 4-ton Plymouth. One of the 8-ton machines is used to serve a shovel reached over

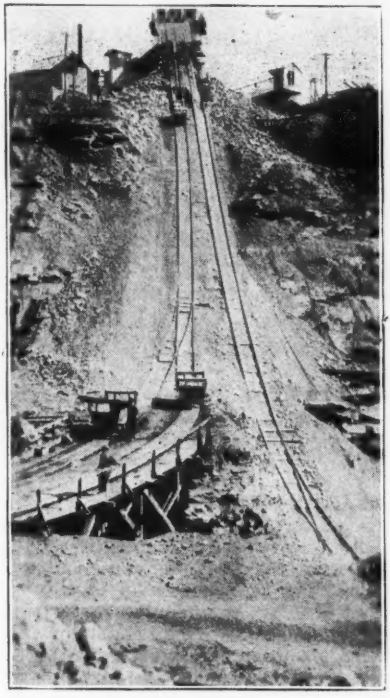
Getting a Load Ready for the Locomotive

a considerable grade and the other is used in connection with stripping to haul four-yard Easton side dump cars.

The tracks over which the cars travel are ingeniously arranged so as to avoid the necessity of manually throwing switches. It has been found possible by cleverly arranging the directions in which the cars should travel and the method of providing turnouts and loops, to have every switch in the plant with but one exception operate automatically by means of springs. These springs are supplied by the J. G. Brill Company. The manner in which the switches must be arranged to accomplish this will of course vary under different operating conditions, but the actual laying out of such a plan is probably not as difficult as most cross-word puzzles, if the idea occurs to any one to try it, but to think of and apply an idea like this deserves much credit.

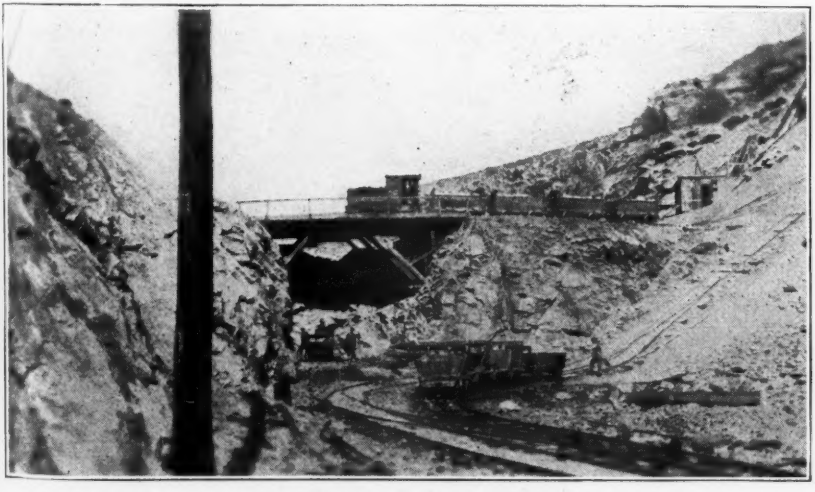
The stone from all working parts of the quarry is taken to the foot of the incline. This has two tracks and the cars are hauled one at a time to the top, a distance of about four hundred feet at an angle of about 30 degrees, by means of two Thomas 100 h. p. elevator hoists and Roebling wire rope. The time for the round trip, including discharging, takes only one minute.

The general appearance of the quarry, incline and crushing plant are shown in the illustrations. When the stone is dumped at the top of the incline it drops onto a scalping grizzly made of rails. The large pieces slip

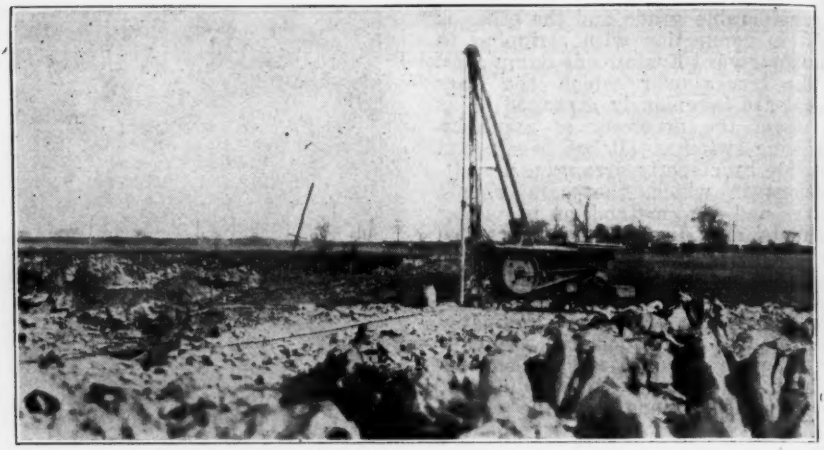


Incline Showing Tracks

off into a 30 x 42 Buchanan jaw crusher. The clean fines from the grizzly drop to the bottom of the plant and are picked up by a 36-inch Robins belt conveyor equipped with a belt made by the same company. The dirty fines drop into a Mc Lana-



Foot of Incline Showing Bridge Under Which Rock is Being Taken Away



Drill at Work After Stripping

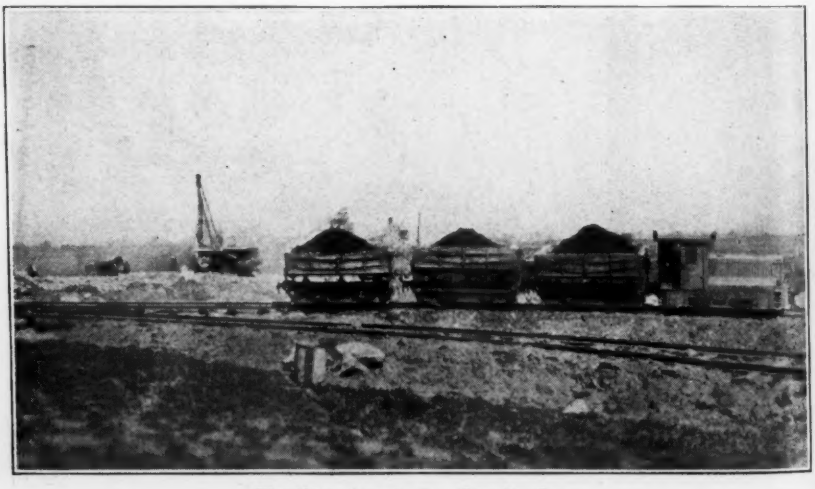
han log washer. After the washing, this material is taken by a Robins bucket elevator and deposited on the belt conveyor previously mentioned.

The jaw crusher also discharges through a plate feeder onto the same belt conveyor. This conveyor discharges onto a five-inch grizzly. The pieces which do not pass through this shoot off into a freight car and are sold to open hearth furnaces.

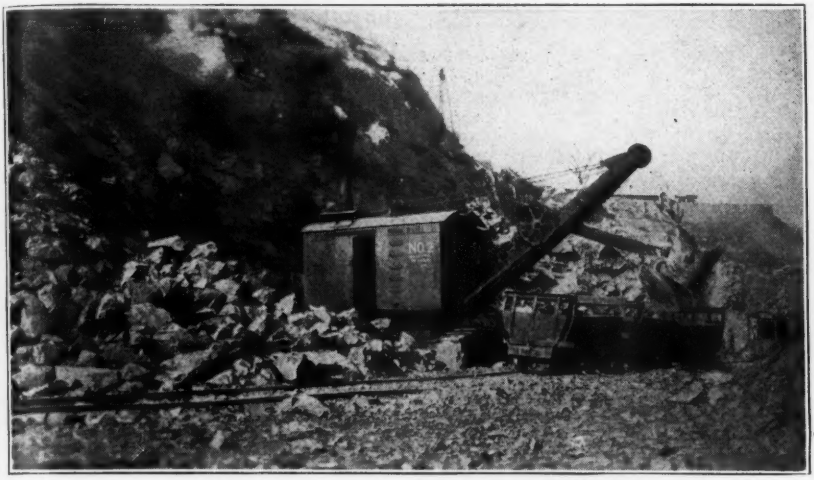
The material which does pass through the five-inch grizzly next drops to a one-inch grizzly. The stone which does not pass through this is shuted into another freight car. This material is suitable for cement mills or blast furnaces. The fines from the one-inch grizzly are used either for road work or cement mills.

There are four pumps in the house at the bottom of the quarry, three of which are used to keep the quarry dry. They are Cameron direct connected pumps, one of 300 gallons and two of 1,000 gallons per minute capacity. The number of pumps operated at one time depends on the amount of water which is coming. Sometimes all of them are needed. The fourth pump supplies water to the cooling jackets of the compressor and jaw crusher. It is a Gould Triplex plunger with a capacity of 40 gallons per minute.

Another rather ingenious applica-



Hauling Away the Overburden



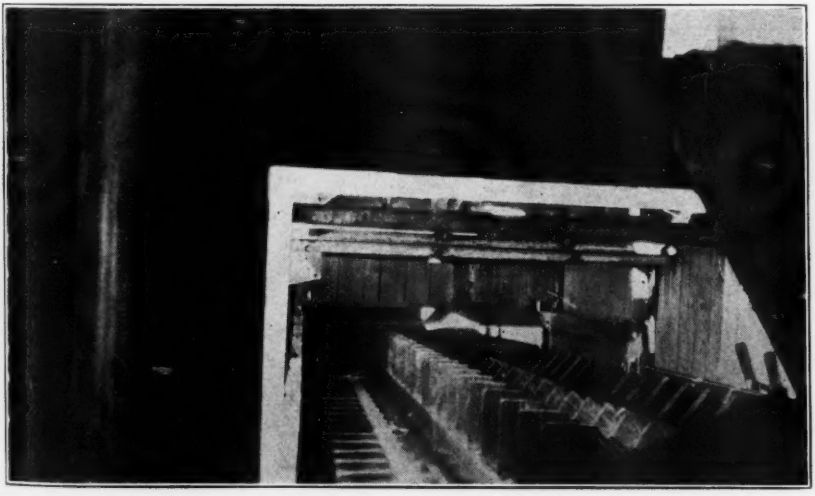
Shovel Loading Stone Onto Dump Cars

tion of a well known operation has been made with respect to the wrought iron water piping. Instead of using pipe fittings, the sections of pipe are welded together. The various bends in coming out of the quarry are of such irregular nature that fittings would be difficult, if not impossible, to obtain. Furthermore threading would be laborious, expensive and hard to maintain water tight. Consequently it is obvious that welding is much more efficient.

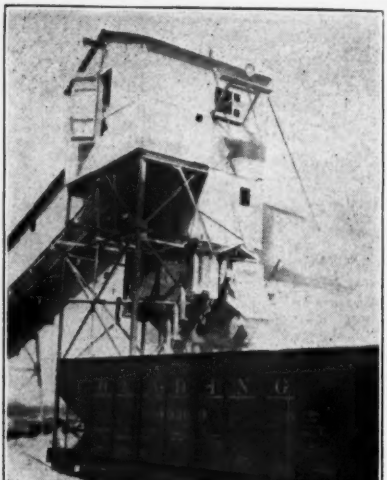
The procedure in installing a pipe line is first to lay the pipes in the ground. Then a man comes along with the acetylene cutting and welding outfit so that after cutting he can immediately do the welding.

Compressed air is supplied by an Ingersoll-Rand compressor having a capacity of 900 cubic feet. It is operated by a General Electric 177 h.p. synchronous motor.

As the entire plant is electrified with the exception of the shovels, and as all the other motors are of the inductive type the synchronous motor is advantageous in maintaining a high power factor. While the central station from which power is purchased does not at present make any reduction in its rates for corrected power factors it is expected that such will



The Log Washer



Belt Conveyor and Loading Chutes

be the case before long. Most of the other motors have been obtained from Westinghouse.

The Calcite Quarry Company is on the point of beginning the development of a new property about a mile distant from its present operation. This development will be rather deliberate and will probably extend over the next two to four years. The company's lease on its present location still has some years to run and it will take considerable time to develop the new one to a point where the opening will be large enough to provide space for the operation of four shovels. Until that is possible the loss of production in abandoning the old operation would be too serious to be considered as a practical proposition.

The new quarry, Mr. Paterson says, is to be as up-to-date from the standpoint of mechanical handling and labor saving equipment in general as it is possible to make it. This sounds impressive in view of the present high degree of efficiency. The new operation furthermore, is to include kilns.

The layout is now being carefully planned and each step as it is taken will be a part of a well coordinated installation. So far matters have not progressed beyond the stage of prospecting with a drill for the best location to begin work.

Glacial Sand & Gravel Co., Phillipsburg, N. Y. Capital $8,000 in preferred, and 1,000 shares no par. Incorporators: A. Fernosmun, Paul F. Beam, Phillipsburg; Harry W. Hazen, Hackettstown. (Attys. Smith and Smith, Phillipsburg.)

Golden Sand & Gravel Company, Johnson City, Tenn. Capital $100,000. Incorporators: George T. Wofford, Sam R. Sells, J. R. Simonds, George C. Sells and A. B. Bowman.

Device for Pulling Up Blast Hole Casings

A Self-Critical Lime Convention

By H. W. Munday

FRENCH Lick Springs Hotel, French Lick, Indiana, was the scene of the eighth annual convention of the National Lime Association. Beginning on June eighth and lasting through the eleventh the convention goes on record as one of the most interesting and profitable of the annual gatherings of this group of producers in the non-metallic mineral industry. This convention was a rather remarkable example of what a great industry should do when its leaders assemble for an annual conference. At any such convention there is a goodly quantity of self-congratulation on the record of the past year. This is only normal, and in the case of the National Lime Association there are many sound reasons for self-congratulation. The self-critical factor, however, played an important part in the proceedings.

The outstanding factor of the convention and also its most creditable feature was the evidence given in several of the sessions of a willingness to face frankly and to discuss openly such problems and possible dangers as may lie ahead in the development of existing conditions into new forms. Such dangers as errors of judgment due to imperfect technical knowledge, and the attachment to the lime industry of unnecessarily selfish interests were discussed in the open and in the executive sessions and quite generally by groups gathered around the golf links and on the hotel porches.

One of the unusual features of the convention was the long executive session on Thursday, which started at ten o'clock in the morning and with a short adjournment for lunch continued until late in the afternoon. This session centered largely around the question, "What is Wrong With the Lime Industry?" This subject was formally opened by W. E. Carson, president of the Riverton Lime Company and was discussed by practically the entire membership. Never before has the lime industry stood in such need of sane, sound thinking on this question. Mere opinion on this question has no standing except as a feeler. The need called for the ability to separate the essentials from the non-essentials and to bring to light the hidden evidence from which straight sound thinking can begin. Those in attendance had an excellent opportunity to contribute to the discussions and thus to make the pool of information larger. It was due to the extension of time of this session

FRENCH LICK SPRINGS HOTEL AND GOLF LINKS
Scene of National Lime Association's annual convention and golf tournament. June 8, 9 and 10, 1926.

that three important papers scheduled for presentation on Thursday afternoon were dropped from the program.

The morning session on Tuesday was devoted entirely to registration and the first half of the director's meeting. In the afternoon session various committees were appointed, and B. A. Ford, secretary of the association presented the report of the Maxet Bureau of which he is manager.

Among the interesting features of this convention were the two round table conferences. The first of these conferences was held at White Sulphur Springs in 1924 and the second at Briarcliff Manor in 1925. The third and fourth were held at this convention. The third, on Tuesday evening was confined to lime manufacturing problems while the fourth, on Thursday evening was concerned with the uses of lime. Professors Haslam of Massachusetts Institute of Technology, Withrow of Ohio State University and McIntire of University of Tennessee were active in these sessions. Professor Haslam, chairman of the conference, opened the session with an explanation of the lime association fellowship work being carried on at his institution. He discussed the rate of solubility of gases in milk of lime suspension, the rate with which heat will penetrate limestone and the effect of temperatures of burning on the plasticity of lime.

Heat distribution in lime kilns was discussed at this same conference by Victor J. Azbe, a consulting engineer of St. Louis. Mr. Azbe opened his discussion by calling attention to the fact that the average lime kiln is very inefficient. As a rule almost 70 per cent of heat is wasted in one way or another. Some of this waste is known to be preventable, other portions are considered as a hopeless loss. As is known, in lime kilns only the heat at high temperatures, (above the decomposition temperature of stone), is available for making lime, and all the heat at tmeperatures lower than this can be used only for preheating the stone. As it happens, however, there is far more heat below the decomposition temperature than is necessary to preheat the limestone; consequently, heat is wasted on kiln tops regardless of how large the kiln is made. In practically all instances, the excess heat is 30 per cent or more of total heat put into the kiln and no practical way is known to utilize this heat even in a theoretical kiln. The heat in the waste gas is too low in temperature elevation and too fluctuating in character to seriously consider it available for recuperator or waste heat boiler purposes.

Mr. Azbe in his practical and theoretical studies of lime kilns has gradually come to the conclusion that there may be a way out, and that a heretofore impossible 100 per cent efficient theoretical kiln may be possible. As a consequence he has designed a kiln which, partially in humorous and partially serious mood, he calls "Ultimos" due to the fact that further improvement in its basic principles is impossible.

The main value of his discussion and of "Ultimos" is that it gives a new insight into why lime kilns are such inefficient contraptions. A practically 100 per cent efficient kiln is, however, impossible. "Ultimos" as shown on paper probably never will be built, but the principles that it presents can, in a modified form, be well adapted in lime plants, and so far some have already given beneficial results. The full text of Mr. Azbe's discussion with illustrations will appear in the July 7th number of Pit and Quarry.

Irving G. Fellner, business manager for the McGraw Hill Publishing Company, was the first speaker on the program Wednesday morning. Mr. Fellner discussed the marketing of chemical lime and made a plea for a technical approach and the selling of chemical lime on a quality basis.

Substantial and economical construction was discussed by J. P. Mollenkof, Superintendent of Construction, John H. McClatchy, Philadelphia, at the same session. The John H. McClatchy organization has always been interested in giving the public the most satisfactory home that can be built for the price involved. This has, of course, necessitated considerable experimental work to determine what materials were most durable and economical. Mr. Mollenkof stated that lime has been found most satisfactory for their mortar, plaster and stucco work.

All plaster and stucco is mixed in a central mixing plant and delivered in trucks to the job as needed. Also, considerable mortar is sent out in the same way. The central mixing plant runs every working day in the year. During the coldest months about 60 bushels of lime are used each day, and during the balance of the year

on an average of 150 bushels of lime are slaked and used each day, four men being enough to run the plant at all times.

The first or scratch coat of both plaster and stucco is gauged with portland cement to speed up the set. In plaster work the second coat is applied before the scratch coat has hardened, using a lean mix. This is found to be entirely satisfactory on all types of backing, including metal lath. On stucco work, however, the scratch coat is allowed to harden for two days before the second and finish coats are applied.

Any type of finish can be secured with the lime mixes used, and the labor and material costs are kept at a minimum. This paper is published in full beginning on page 93 of this number of Pit and Quarry.

Balanced publicity, discussed by R. P. Brown, manager of the publicity department of the National Lime Association, was one of the excellent subjects presented.

The preparation of publicity for an industry as large and as diversified as the lime industry calls for careful balancing, pointed out Mr. Brown. Seven points of basic importance at each of which a balance should be struck were given. They are:

1. Balance as to type of material.
2. Balance as to subject matter.
3. Balance as to readers.
4. Balance in departments.
5. Balance between departments.
6. Balance in the Association.
7. Balance between Association and members.

The function of the National Lime Association was defined to be the assembling of data, working it into form and making it available to the public. This may be through the medium of: bulletins, articles, folders, films, newssheets or press releases. The bulletin is most important and the semi-technical type of bulletin may be considered as the backbone of the whole program, for from it all the other types of publicity may be developed in the opinion of the speaker.

As lime plays a part in all branches of modern life, so should data on it reach all classes of readers. The problem is to prepare the information in such form that it will be acceptable to each group and then to see that it reaches the group in such a way as to be of the greatest good to all. The final balance is achieved through the cooperation of member companies and the Association in distributing literature, the numbers handling all material which goes directly to prospective purchasers, and the Association sending out the purely technical material, together with such publicity as is broadcast, namely articles and press releases. This paper will be published in full in the July 7th number of Pit and Quarry.

J. S. Elwell, Manager of the Construction Department of the National Lime Association presented an excellent paper entitled, "There Is No Substitute," on Wednesday afternoon. The following is a brief abstract while the full paper will appear in the July 7th number of Pit and Quarry.

Lime is indispensable in construction. It has always been used, it is used today, and will be used whenever and wherever permanent and economical building is done. Its construction uses fall into the four main classes of stucco, plaster, mortar and concrete, in each of which special advantages are noted. Stucco, which is fundamentally a covering to concealing and protecting other construction must be composed of material which will withstand all weather conditions. That lime stucco meets all these conditions has been demonstrated in all sections of the world and in all ages. Lime stucco is not only durable but is economical. It may be finished in any desired texture or color and the ease with which it works makes possible uniformity in the appearance of the finished coat.

No use of lime is more important than interior plaster. It has been proven in the laboratory and in the field as well that lime plaster protects metal from corrosion, is a fire retardant, and is the most efficient for sound insulation. Lime mortar was the first mineral binder used by man when he started to build and has continued through the centuries as the best mortar material. Its durability is established, its strength is greater than is required under the types of construction now in common use, its economy is great, and its plasticity is necessary.

Lime plays an important part in good concrete construction in which it acts as a lubricant, facilitating placing and at the same time preventing segregation. It makes the concrete permanently watertight. In the field it makes possible the use of less water in mixing structural concrete and as is well known this reduction in mixing

water increases the strength of the concrete. Concrete containing lime is more uniform in the forms than concrete without. The stresses induced by variations in the moisture content of hardened concrete are materially reduced when lime is added, and a smoother, more uniform, and lighter colored surface is obtained.

The discussion that followed this paper was also interesting. Mr. K. J. Zink of Kansas City pointed out some pertinent facts among which he stated,

"Lime stucco has proven its durability by being used as far back as 470 B. C., and this stucco is still in a good state of preservation. It has proven its ability to keep water from penetrating the walls, which is something no other substitute can claim. The adhesive force of a mortar determines the efficiency and strength of a masonry wall, and there is no substitute that develops as great an adhesive strength as lime. The factor of adhesion is very important in masonry work because the wall is only as good as the bond. Laboratory tests of substitutes are interesting but not always conclusive. Concrete to be efficient must have a minimum amount of water. It must be workable. It must be impermeable. Hydrated lime should be used as it is essential to obtain those results."

The great marketing and service opportunities open to the lime industry in the industrial field were discussed by L. B. Burt, Manager of the Industrial Department, National Lime Association in a paper entitled, "Opportunities In the Industrial Field."

In this discussion of the opportunities it was pointed out that lime is more economical than any other material possessed of similar chemical properties. Opportunities, however, are only profitable when they are developed, and it was pointed out how advantage might be taken of many new fields, and how better use might be made of some of the existing opportunities. Industrial processes are developing at an increasing rate and it is only by keeping abreast with these developments that lime will continue to be the leading base in chemical practice.

The use of lime has enjoyed a substantial increase in water softening and purification practices, and the immediate ruture looks even better than the past. Municipal water softening has trebled in the past three years and there is every reason to believe that the rate of increase will continue to be accelerated for some years to come.

In the treatment of trade wastes lime is destined to function very largely as a neutralizing and precipitating agent, in some cases assisting in the production of commercially valuable by-products. Progress is reported in the treatment of coal mining, creamery, tannery and steel mill wastes. The activity of all state boards of health is directed toward an early solution of the trade waste problem and the Lime Association will be glad to cooperate in such work. A very important development along that general line is reported from the oil fields where stream pollution by wastes carrying salt water have for years been a serious matter. This development, in which lime performs an important function, solves the pollution problem and converts the waste into useful products. The full text of this paper appears on page 85 of this same issue of Pit and Quarry.

Because of the lack of time three papers scheduled were not presented. One of these appars in full on page 61 of this number of Pit and Quarry, and a second appears on page 77. These are "Lime in Concrete Highway Construction" by C. R. Stokes and "Lime in Earth Roads" by H. W. Wood. Both authors are with the National Lime Association. The third paper was to have been presented by G. J. Fink, Director of Association Laboratories, National Lime Association, entitled, "The Practical Aspects of Research." This paper will be published in full in the July 7th number of Pit and Quarry. The following is an abstract of this paper.

Research is always found in both the vanguard and the rear guard of safe and successful promotion of any product. A research department must furnish a continuous supply of unquestionable information and data to be passed on to other departments and to members and users. Facts must be available in order that reliance may not have to be upon precedent alone.

The Laboratories of the National Lime Association comprise three closely related units, namely, chemical, physical and research extension, and a three-fold function is performed in the initiation of research, in the investigation of problems suggested by other departments, members and consumers and in the miscellaneuos service offered manufacturers and users. These activities involve routine testing, laboratory and field investigations,

fundamental research, and surveys of scientific and technical literature.

As examples of the specific services offered by the research laboratories, the Construction Department is furnished with experimental and test data on mortars, plasters, concrete and other structural materials and products, properties of satisfactory plastering sands, etc.

For the Highway Department, soils and asphalts to be treated are tested and data on the effect of lime is supplied. This relatively new activity will undoubtedly uncover many questions which research alone can answer.

The Industrial Department is supplied with information on the properties and functions of limes as related to chemical and industrial processes such as pulping of wood, absorption of gases, trade waste treatment, manufacture and use of insecticides, and some 600 other uses.

The Publicity Department is furnished abstracts of scientific literature and digests of technical developments in connection with lime processes and uses.

In the field of research extension, cooperative investigations are arranged with users and with manufacturers of equipment for processes using lime and fellowships are maintained and cooperative research is initiated in various institutions and industrial laboratories. New methods are developed, specifications are established, illustrative and lecture material is furnished chemical courses, and attention is continuously directed toward lime as a chemical raw material and intermediate.

The rapidly increasing use which is being made of technical information and data by lime manufacturers and salesmen, by lime users and by investigators, is a favorable index of increased appreciation of lime, and the 50 per cent increase during the past year in the number of lime plants employing chemists indicates the increasing desire to improve products and to sell service. All such developments must necessarily elevate the plane of the industry and unquestionably react favorably upon both producer and consumer.

The second session of the directors meeting was held on Thursday afternoon and the fourth round table conference on Thursday evening. This round table conference, which was the second of this convention, centered its discussion around the uses of lime.

The social side of this convention was an important feature. A bridge party was held on Tuesday evening. A banquet was held on Wednesday evening and excellent entertainment was presented through the courtesy of the Valve Bag Company of America. A golf tournament was carried on which lasted through the length of the convention. Tennis and quoit tournaments were also held. The recreational and social side of this convention took up about half the time of the convention.

The eighth annual convention of the National Lime Association officially adjourned at a luncheon on Friday June 11, 1926, with everyone rested and glad to have been present. The convention plan represented a well organized and highly constructive group of papers. Charles Warner continues as president and J. J. Urschel as vice president for another year. The only changes in the officers of the association for the coming year were in a few director's positions.

New Foote Catalog

A book of more than 600 pages is to be considered good sized with plenty of space, yet it is surprising how much valuable information has been packed into the 621 pages of the new catalog of the Foote Brothers Gear and Machinery Company. The effort of the editor to waste not even a single line is obvious. The book is more than a catalog, as its title tells, "Gear Problems and IXL Speed Reducers" is a real service manual.

It contains engineering information on speed reducers, conveying equipment, gears of all kinds, mathematical tables, and a wealth of engineering information on mechanical engineering subjects.

As an aid to quick reference it is indexed by subjects in the upper page corners, and has a complete cross-referenced index in the back.

The company has been told by competent engineers that "Gear Problems" is the most complete and useful reference book on the design and application of modern speed reduction units and industrial gearing of all kinds that has ever been published.

Chief engineers, designers, production or maintenance engineers, and any plant executives who are concerned with power transmission or the operation and upkeep of machinery will find "Gear Problems" a valuable reference book.

A Stevenson Test Plant

The Stevenson Company of Wellsville, Ohio, have installed a test plant at its factory using a commercial size single screw washer. This machine will be nearly as efficient as the double screw machines. The Stevenson double screw machine gives the material more scrubbing because of more slippage in the washer during the scrubbing period.

This test plant has been installed in order that sand and gravel producers, etc., may have a practical test made without cost except for the transportation of materials. This service will make it possible for the Stevenson Company to adjust its machine to handle the peculiar conditions appearing in any particular instance. Such a service should meet with success as there is a wide range of conditions to satisfy and each condition must be satisfied.

National Agstone Meeting

The National Agstone Association will hold a big summer meeting on June 24th and 25th at Ohio State University, Columbus, Ohio. The meeting of the members and directors of the association will be held at ten o'clock on Thursday, June 24th, at the Neil House. The meeting at the University will be held on June 25th. The morning session will be devoted to field work and the afternoon meeting will be in charge of Dr. Firman E. Baer, Chief of Soils Department, Ohio State University.

Two years ago an interesting meeting was held at the State College of Pennsylvania. Last year the meeting was held at Ohio Experimental Station at Wooster, Ohio. Agricultural limestone is the subject of these meetings and are well worth attending.

Curtis Air Compressors

Curtis air compressors bear a high reputation for efficiency and dependability. They are well designed, strongly built, and the material and workmanship are of the highest order. They are lubricated automatically by a controlled splash system with regulatable sight feed for cylinder oiling. An air pressure unloader can be furnished.

The machines are made entirely in the company's own plant. The design is the result of 29 years experience in the manufacture of these machines. Suction and discharge openings are of liberal size in order to reduce friction losses and are located below the heads. The heads on double cylinder machines can be removed independently of each other. The valves and air pressure unloader can be removed without removing the heads.

All parts are made to template and are interchangeable. The fly wheel is large and heavy thereby imparting a steady non-pulsating drive. The compressors can be mounted on trucks for portable work and driven either by an electric motor or by an internal combustion engine.

Water jackets completely surround the cylinders, heads and valves giving a much greater cooling surface than a double acting machine of the same capacity.

The Sand Blast Manual

The "Sand Blast Manual" first and only textbook on the operation of the sand blast for memorial carving and lettering has been published by the Monumental News of Madison, Wisconsin. It is a complete handbook of practical instruction on how to install the sand blast and how to use it in monumental work of every character from the simplest lettering and line work to the sand carving and two-tone blowings that are among the most recent developments.

The book is divided into twenty-nine chapters. Some of the most interesting are:

Harnessing the Sand Storm
What the Sand Blast Will Do
Technique of the Process
Housing the Sand Blast
Experience of Sand Blast Users
Dust Removing Devices
Preparation of the Work
Applying Design to Coating
Short Cuts in Preparing Work
Hints and Helps for the Operator
Plan and Layout of Plant
Preparing the Stone
Modern Methods in Sand Blasting
Improved Mechanical Equipment

It is bound in a flexible cover and contains 192 pages and more than 180 illustrations. The price is $12.00 per copy.

Westinghouse Promotes Seybold

Roscoe Seybold, formerly manager of price statistics of the Westinghouse Electric and Manufacturing Company, has been appointed assistant to F. A. Merrick, vice-president and general manager of the company.

Lime in Concrete Highway Construction

By C. R. Stokes

Manager Highway Department, National Lime Association*

ONE of the greatest enterprises, if not the greatest, in this country today is the construction of concrete streets and highways, to provide adequate and safe transportation facilities for the ever increasing number of motor vehicles. These streets and highways must be permanent, and the best that money can buy. Those most concerned; the public, the engineer, and the contractor, are vitally interested in any factor which will assure of permanence and quality of construction. Such a factor is hydrated lime, which has proved to be a tremendous asset in securing good concrete. Several states and a large number of municipalities have discovered the many advantages of lime in concrete and have been consistently using it in their concrete pavement construction for some time.

Data collected during 1924 and 1925 in Wisconsin, Louisiana, Ohio, Connecticut, Virginia, Delaware, and Massachusetts shows conclusively that lime makes the mix more uniform, holds the water cement ratio more nearly constant, improves the finish and riding qualities of the road and imparts the same or greater strength to the concrete. All of this contributes toward the security of the highway investment and benefits the general public, the contractor and the engineer.

The question quite naturally arises as to how this material is used with the other ingredients which go to make up concrete and what resultant effect it has. Let us then, for example, follow through the construction of a concrete paving slab and by comparison note the various effects of lime.

After the subgrade has been properly prepared and the side forms set to the correct grade and alignment, the mixer is moved to its place between the forms and the job of pouring the concrete slab is ready to begin. The mixer may be charged by hand from stock piles of aggregates along the subgrade, by trucks, or industrial railway hauling from a central proportioning plant. In the latter case the cement may be placed loose on the load at the plant or dumped directly into the paver skip. It is customary to follow the same procedure in adding lime to the batch. However, as much smaller amounts of lime are used than cement, a portion of the 50 pound sack of lime is first poured from the sack into a suitable container for measuring the correct amount. This quantity must be predetermined by taking into account the mix proportions, kind of aggregates, etc. The leaner mixes necessarily will require more of an admixture than the richer ones, but to simplify matters let us say that a 5 bag batch of 1:2:4 proportions requires the addition of 25 pounds of lime or a 5 per cent by weight of the cement. This then is the amount to be added to every batch and as lime is delivered in 50-pound bags, the measuring is simplified, for the bags can be cut in half to obtain the required amount.

The first important thing to be borne in mind when ready to mix and pour concrete is proper control of the consistency. Concrete for highway construction must be mixed with the least possible amount of water. As any engineer will testify, in the field this is a different thing to accomplish and still obtain a concrete which can be easily and properly handled. It can be done without much trouble in the laboratory, but laboratory refinements are neither economic nor practical in the field. The use of hydrated lime is the answer ior the most practical and economical way to control consistency and obtain uniformly dry concrete in the field. As has been demonstrated on many different jobs, lime has a higher affinity for water than cement, so it actually takes up moisture and dries up the mix. Slump tests will further demonstrate this fact, for a comparison of slump test results between concrete with and without lime and containing the same amount of water, will show from 2 to 3 inches less slump in the concrete containing lime.

As the mixed concrete leaves the paver drum and is deposited on the

* Prepared for presentation before the Eighth Annual Convention, National Lime Association, June 9th to 11th, 1926, French Lick, Indiana.

subgrade the necessity of proper consistency is emphasized. If too much water has been used in mixing, the concrete is badly segregated. The mortar is thin and soupy and does not cling to the surface of the aggregates. Concrete of this nature cannot be worked into a dense and compact mass. In sharp contrast, properly mixed concrete containing lime is deposited in a smooth plastic mass, wherein every piece of aggregate is thoroughly coated with thick mortar and the whole batch bonded together into a uniform and homogeneous mixture. A mixture of this character can be easily worked into a dense, watertight slab of concrete.

Concrete containing lime is handled efficiently and very easily by the workmen who spade it into place between the forms. Being in a plastic mass with a sufficient mortar content, it can be shoveled into place with the minimum of effort. This is far from the case in a dry mix containing no lime and likewise in one that is too wet. The former is harsh and not at all plastic, while the latter is segregated to such an extent that the workman finds himself shoveling coarse aggregate in place of concrete.

Aside from the practical proof of the greater workability of concrete containing lime, some interesting laboratory experiments have been conducted along these lines by J. C. Pearson and F. H. Hitchcock, of the U. S. Bureau of Standards, Table 1, taken from their paper on "Economic Value of Admixtures," presented at the American Concrete Institute in 1924 show conclusively that the addition of hydrated lime improved the workability of concrete mixtures. It is further stated in this report that, "the improvement in workability which is affected by these maximum additions is about that which should be expected by a 25 per cent increase in the cement content. It would be hard to justify such a cement addition on an economic basis.

Table I

Effect of Hydrated Lime on Workability of Concrete Mixtures. The lower the workability figure, the easier it is to handle the concrete.

Per Cent Admixture by Weight	Workability Figures 1:1½:3	1:2:4	1:2½:5	1:3:6
0	44	108	169	242
5	33	103	167	202
10	31	81	125	185
15	..	..	129	171
	82	92	140	188

When the workmen have thoroughly spread and spaded the concrete on the subgrade, it must next be struck off and tamped to the level of the forms. This is done either by hand screed boards or mechanical tamping machines. If the concrete is too wet and therefore segregated it necessitates much extra tamping in an effort to fill up the porous spots and even then the chances are greatly in favor of voids not properly filled forming dangerous bridging in the lower half of the slab. Likewise a stiff, dry, harsh working concrete will require the very maximum of effort before it can be properly compacted. However, when the concrete has been properly mixed and contains lime, it is already in a plastic, dense mass and can be compacted easily and safely. The necessary mortar will be brought to the top with less tamping, a saving in time and labor and better for the concrete itself. Concrete of this nature is particularly necessary on grades and sharply super-elevated sections for it is stiff enough so that it will not sag away from the several board or tamping machine, and yet it is so easily handled that the same speed and ease of operation maintained on level operations can be maintained under the more difficult conditions described.

The actual finishing of concrete pavements is done in many different ways. Probably the method most prevalent is the use of an improved hand roller following the tamping operation, to remove excess water, and then to smooth the surface with a canvas belt. Methods such as wood floating, "flap-jacking," etc., are employed in certain sections of the country.

Regardless of the method used, the dryness of the concrete is the controlling factor as to how fast or how slow the concrete can be finished. When concrete has been poured too wet the finishers are frequently 200 feet or more in the rear of the machine or screed board, which can only mean overtime finishing in every instance. The reason for their being so far behind is apparent when it is considered that several rollings are necessary to remove the excess water.

With concrete containing lime this is not the case. The lime takes up water so that the concrete when spread out in slab form does not contain any appreciable amount of excess water. In fact, this feature of concrete containing lime is so pronounced that a roller has been said to be an unneces-

sary tool on a lime concrete job. This is a decided advantage when a tamping machine is in use for the belt on the machine can be used during the last tamping operation. On the hand finished job the advantage is also very apparent, for the finishers do not have to wait for the rolling, but can work close behind the tamping operation. It can readily be seen that the danger of "overfinishing" is practically eliminated through the use of lime.

In the matter of protecting the finished concrete slab against the elements and proper curing methods it should be said that a concrete pavement slab containing lime should be given the same treatment as is normally used. However, it is less liable to craze or hair crack than a concrete slab containing no lime because lime concrete is dry when placed and finished, and therefore not subject to the too rapid drying out action caused by certain temperature conditions.

Every precaution should be exercised to see that concrete placed in the road slab is uniform. There must be a uniform distribution of the aggregate throughout the mass, and this is difficult to secure with a harsh, dry mix containing no lime or one which has been mixed too wet. Lime added to the mixture imparts to the mortar a smoothness and plasticity, yet keeps it sticky enough to cling to the coarse aggregate and bind the whole into a uniform and homogeneous mass.

Table 2
Shelton-Nichols Road
90 day tests on field made cylinders
6% Lime by Weight of Cement
Compressive Strength
lbs. per sq. in.

Strength With Lime	Flow	Strength Without Lime	Flow
4803	109.2	5125	112
4647	115.0	4875	115
4824	121.0	4754	120.5
5098	122.5	4400	122.5
4729	125.7	4690	126.5
4865	128.5		
4717	131.7	5090	131.0
4682	136.3	4823	136.6
4340	148.5	3970	145.0
Average 4745		Average 4716	

The manner in which a subgrade supports a concrete road slab is not definitely known. In some cases the slab may be uniformly supported over the entire area. At other times the slab may be acting as a simple beam, while again it may be partially supported at irregular intervals. The load it must carry ranges from heavy impact to simple dead load, and the stresses due to these loads over uncertain supports are still further complicated by stresses induced by moisture and temperature variations. Concrete uniformity is, therefore, extremely important. It is probably best demonstrated by the results of cylinder tests and by the nature of cracks in the finished road.

Perhaps the most convincing and positive test for uniformity is the location and direction of transverse cracks in the finished road, together with the length of the interval between cracks. We are referring now to a concrete road in which expansion joints have been omitted and construction joints placed at the end of each day's run. On an average concrete pavement containing no lime, the transverse cracking will follow the lines of least resistance and shows no uniformity of spacing or direction. Diagonal and branched cracks are serious as well as unsightly, for they are conducive to corner breaks and shattering. A concrete road which has many such diagonal, branched or corner cracks prevents a serious problem in maintenance and is also a constant source of worry, because it shows that the concrete is not uniform and that it is only a question of time until it will fail completely.

Referring once more to the paper on "Economic Value of Admixtures" presented by Pearson and Hitchcock, the authors state in their conclusions that: "The results of the tests reported herewith indicate that a judi-

Table No. 3
Wisconsin Federal Aid Project 319
Being a test of field made specimens at 28 days
1:2:4 Concrete

	Transverse Strength of 4½"x8"x19" beams Mod. of Rupture lbs. per sq. in.	Compressive Stregth 6"x12" cylinders lbs. per sq. in.
No lime	673	2640
	753	1905
	687	2755
Average	704	2433
5% lime	822	2700
	810	2928
	793	3177
Average	808	2935

cious use of admixture in concrete which need improvement in respect to workability will not materially impair the strength." This is certainly correct, but to carry it still further, it has been definitely proved by numerous field tests that the use of lime in the leaner concrete mixtures produces even greater increases in strength. This is easy to believe when it is seen how lime controls the water ratio, the are no stiff batches which will remain high, or soft batches which can settle after the finishing operation, for lime eliminates the possibilities of alternate wet and dry batches so common on the usual road job and thus makes possible a smooth, even finish, sufficiently gritty to provide good traction, and free from stone pockets or patches of laitance.

It is readily apparent that lime, when applied to the construction of a concrete road slab, has numerous advantages. It is better to depend on such a well-known material to produce the ultimate in satisfactory concrete, rather than to be continually theorizing and guessing as to how the job will come through. The cost of lime is a small item, but when it is considered that it best serves the purpose with the leaner mixes, we are immediately confronted with tremendous saving possibilities. However, the true economy of construction is not so much in the cost of the materials which are involved, but rather the obtaining of a permanent and satisfactory job.

Table No. 4
90 Day Tests of Field Specimens from Janesville-Delavan Road, Wisconsin
Wear Results
4½x8x19" Beams—1:2:4

With 5% Lime Weight				No Lime Weight			
Specimen	Before	After	% Wear	Specimen	Before	After	% Wear
J-1	66.6 lbs.	62.2 lbs.	6.3%	J-21	69.9 lbs.	67.1 lbs.	4.0%
J-3	61.4 lbs.	57.6 lbs.	6.2%	J-23	59.3 lbs.	55.4 lbs.	6.6%
J-19	65.3 lbs.	62.7 lbs.	4.0%	J-25	58.9 lbs.	55.2 lbs.	6.3%
J-5	65.5 lbs.	61.3 lbs.	6.4%	J-27	58.1 lbs.	55.0 lbs.	5.3%
J-7	64.8 lbs.	61.8 lbs.	5.0%	J-29	57.5 lbs.	54.5 lbs.	5.2%
J-9	64.0 lbs.	60.9 lbs.	5.0%	J-32	57.6 lbs.	57.6 lbs.	6.0%
	64.6 lbs.	61.0 lbs.	5.5%		60.7 lbs.	57.4 lbs.	5.7%

Transverse Strength
4½x8x19" Beams

With 5% Lime		No Lime	
Specimen	Lbs. Sq. In.	Specimen	Lbs. Sq. In.
J-5	720 lbs.	J-31	1000 lbs.*
J-7	840 lbs.	J-33	1000 lbs.*
J-19	833 lbs.	J-35	930 lbs.*
J-9	840 lbs.	J-21	1070 lbs.*
J-3	873 lbs.	J-25	860 lbs.
J-1	962 lbs.	J-23	910 lbs.
J-12	1053 lbs.*	J-27	850 lbs.
J-15	1121 lbs.*	J-29	870 lbs.
J-17	940 lbs.*	J-32	725 lbs.
	920 lbs		912 lbs.

*Specimens were not in the rattler before cross bending
6x12" Cylinders Made Concurrently with Beams

With 5% Lime		No Lime	
Specimen	Lbs. Sq. In.	Specimen	Lbs. Sq. In.
J-1	4130 lbs.	J-21	3050 lbs.
J-3	4700 lbs.	J-31	3480 lbs.
J-5	4550 lbs.	J-33	4100 lbs.
J-7	4200 lbs.	J-35	3820 lbs.
J-9	3970 lbs.	J-29	3490 lbs.
J-12	3440 lbs.	J-27	3370 lbs.
J-15	3660 lbs.	J-23	3560 lbs.
J-17	3520 lbs.	J-25	3240 lbs.
Average	4021 lbs.		3514 lbs.

The public is particularly sensitive to the appearance and riding qualities of a concrete road, especially the latter. If it rides smooth, the road is good—if not—the job has been poorly constructed. The use of hydrated lime helps the engineer and contractor to secure the most uniform, smooth and even finish. Concrete containing lime is uniform and homogeneous throughout, and therefore can be uniformly compacted to the exact contour and grade. Once struck off and tamped, it maintains its crown and may be finished smoothly and evenly. There

United States Gypsum Company Opens Big Expansion Program

CONSTRUCTION of a complete new plant at Detroit, intended to become one of the largest gypsum mills in the United States; erection of a new paper mill at Oakfield, N. Y., and a new board factory and specialty plant at New Brighton; opening of systems of warehouses on the Pacific Coast and in the region surrounding New York; and expansions of properties at Gypsum, Ohio, Sweetwater, Tex., Southard, Okla., and Plasterco, Va., were announced by the United States Gypsum Company last week as part of its 1926 building program. Some of these constructions already are under way; others, about to be undertaken; all are expected to be in operation before the end of this year.

Seven acres of industrial property on the River Rouge, Dearborn, Michigan, were purchased from the Joseph H. Berry Estate on March 29, last. Here ground is being broken now for a calcining plant, a mixing plant for the production of sanded plasters, a board mill to produce Sheetrock wallboard, "Rocklath" or plasterboard and "Gyp-Lap" fire-resistive sheathing lumber, and a tile plant. The buildings will be of permanent construction and only the most modern equipment will be installed.

Concurrent with this construction, the company is building a breakwater and concrete dock at Alabaster, Michigan, where one of its oldest quarries is located. Automatic loading devices will be installed, and raw gypsum will be shipped from there to River Rouge in boats to be owned by the company. This construction is required to meet the demand for the company's products in the Detroit industrial field and throughout Eastern Michigan, and will permit of economical efficient distribution of materials to dealers by means of their own trucks.

Erection of the paper mill at Oakfield has been under way for some time, and this new unit is expected to go into operation during the present month. This new construction is located a short distance from the main plant, and consists of a paper-mill building 45 x 500 feet in size; a stock warehouse 60 x 280 feet; a boiler room 60 x 40 feet, and a turbine room 60 x 20 feet. All of these buildings will be built with frames of reinforced concrete and with roofs and curtain-walls of "Structolite" structural gypsum; the rooms being so constructed so as to prevent the condensation of moisture which might damage machinery and product.

Only the latest type of equipment, as improved by the company's engineers on the basis of experience at its paper mill at Gypsum, Ohio, has been installed. The principal units of the installation are one six-cylinder paper-making machine that produces a 112-inch sheet; 60 driers; a Straton furnace; two 500-h.p. Erie City boilers. The most modern types of beaters, bins, screens and storage facilities are included in the construction.

Its output will be 75 tons a day of news-lined chip paper, which will be used at Oakfield and at New Brighton, N. Y., and Plasterco, Va., for the exterior surfacing of the company's three board products.

At New Brighton, a new specialty plant is expected to go into operation about July 1, to produce 200 tons a month of a new product, Plastint, a plaster tinted so as to provide decoration as well as structural wall-finish. The material, introduced to the building trades last January, is being extensively used for commercial buildings, apartments and dwelling-houses as well as other types of construction.

The expansion of the specialties plant which was built last year at Gypsum, Ohio, also has been made necessary by the demand for this material. The plant-building is being extended on both sides, and new blending, grinding, mixing and packing equipment is being installed. Additional warehousing facilities and laboratory equipment to permit of a high degree of control in the manufacture of this material in nine colors, are being added both at Gypsum and at New Brighton.

The other construction on Staten Island is a new board mill for the production of Sheetrock, Rocklath and Gyp-Lap. It is expected to begin next fall to produce 300,000 square feet a day of these boards. The building

will be two stories high, 36 x 565 feet in size, built of steel, concrete and brick, with a gypsum room. On the upper floor will be two board machines and the kilns; the floor below will be used for storage, truck-loading and car-shipments.

In order to provide calcined gypsum for the new operation, considerable extensions are being made to the calcining plant. The principal items here are two new oil-fired rotary calciners, 150 feet long, which will double the stucco capacity of the plant. The United States Gypsum Company has let contracts for the construction of two steel cargo-steamers of 6,000 deadweight tons each, to facilitate and expedite the transportation of rock from Nova Scotia to New Brighton, and the large silos built at the latter point last summer will be used for rock storage.

Brooklyn, Harlem, and Harrison, N. J., are the locations of the first three units in a new system of warehouses being built up in the region supplied by the New Brighton mill. A complete line of the company's products will be stocked at these warehouses. These distributing details are not to be used, and the company does not contemplate their use in the future, as retail establishments. They are being built solely to afford more efficient distribution of commodities to lumber and mason's-supply dealers.

The Harrison warehouse will be a permanent structure of steel and Structolite, 56 x 208 feet in size, located at Sussex street and the Passaic River. Adjacent to it will be a barge-slip, at which the company's boats will dock with cargoes from New Brighton. These cargoes will be unloaded by an electrically operated overhead traveling crane, and will be held in the warehouse until required by dealers. They will be loaded onto the dealers' trucks by means of the same equipment.

This warehouse and the one at Harlem have just been put under construction. The latter is located at 135th street and the East River, is similar to it in construction, and will be 56 x 240 feet in size. A concrete dock is being built and a locomotive crane probably will be installed for unloading. A high bridge crane probably will distribute the materials in the warehouse, and load them onto trucks.

Los Angeles, San Francisco and Oakland, Cal., Seattle and Portland are the points on the Pacific Coast where warehouses will be located for the same purpose. These buildings are not yet under way, nor have the properties been selected in all instances.

At Sweetwater, Southard and Plasterco, the board mills are being expanded. Capacity will be increased 65 per cent at Plasterco, through extensions to both ends of the existing board plant, additions to the kilns and to facilities for paper storage and storage of products. Personnel throughout the works is being increased accordingly.

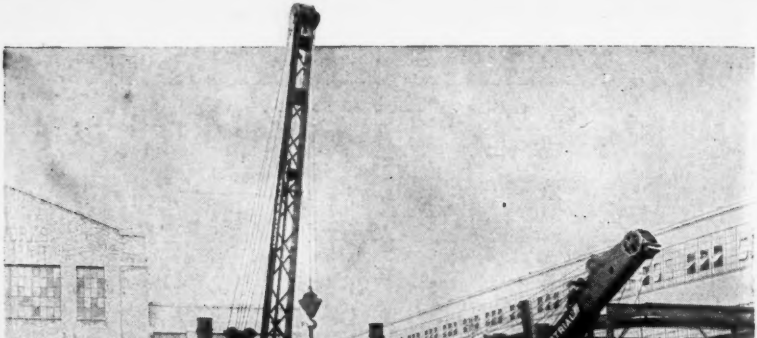
The capacity-increase at Southard will be about 50 per cent. This requires additions to the present Sheetrock warehouse and construction of a new crushing mill and grinding mill. A new 16-ton steel-shell, firebrick-lined calcining kettle also is being installed, making the fourth unit in the calcining plant. New boilers, dryers and other equipment also are being put in.

New construction and equipment at Sweetwater includes: a bag-products warehouse, an addition to the main mill, an extension of the power plant —all the new construction to be of steel and corrugated iron; a 16-ton calcining kettle, the sixth one in this plant; a rotary drier, and other changes necessary to increase board production.

At all three of these last-named plants, the expansion of board-producing capacity is partly due to the increasing demand for Gyp-Lap, the fire-resistive sheathing, which the company put on the market last year. This product, together with Rocklath or Sheetrock and a dry-fill gypsum insulator called Thermofill, contribute to the "protected frame" system of construction which the company has been advocating, and additional production-capacity is required to meet the demand for quality-construction in the Southern states.

Buys Fairbanks Shovel Assets

The Osgood Company has purchased from the receiver the good will and all the assets of the Fairbanks Steam Shovel Company, such as patterns, records, drawings, formers, etc., together with the entire stock of material that was on hand for the manufacture of steam and gas shovels and dredges.



The proof of the pudding—

EVERY INDUSTRIAL machine is fully tested under its own power on the INDUSTRIAL WORKS test track before shipment. Full capacity loads, both at maximum and minimum radii are actually lifted and swung and all functions of the machine are thoroughly tested.

A service test of continuous operation is also run to insure that all parts work properly and that all bearings and clutches are properly adjusted for operation, so the purchaser is assured of receiving a machine with all adjustments made, and that has been fully tested. These tests are not of a perfunctory nature, but are detailed and exacting, and are made by an independent final testing department to check the finished work of the various shop departments and to detect any maladjustment or hidden weakness. A certified test report giving a brief summary of its test is posted in each machine before shipment. A representative of the purchaser will be welcome at this test.

Considerable expense is involved in providing the facilities and in carrying out, so scrupulously, all the preliminary and final tests. The value to the customer, however, cannot be overstated. He is thereby assured of a machine built of tested units of ample size and proven quality, and one which, after completion, and under its own power, has demonstrated its fitness to do its work. By building quality into INDUSTRIAL products the purchaser secures safety, durability and long-continued efficient service—another reason why INDUSTRIALS excel.

INDUSTRIAL WORKS · · BAY CITY · MICHIGAN

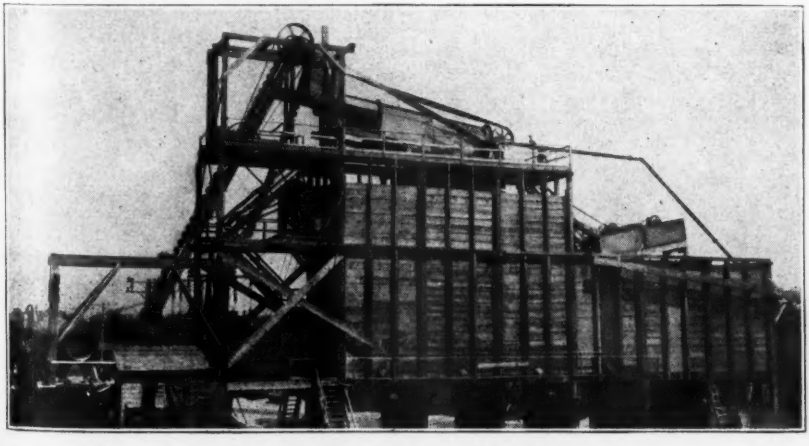
New Efficient Sand and Gravel Plant Invades Milwaukee Territory

By E. D. Roberts

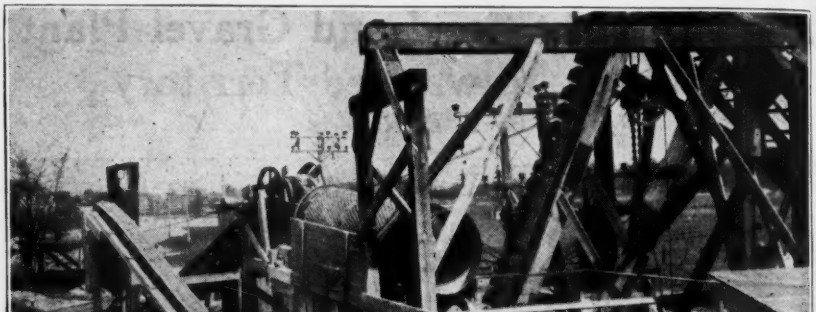
INSPECTION of a plant which is satisfactory to everyone, including the operator, designer, and owner, is a pleasant task. This is especially true if the plant has been in operation long enough to be thoroughly tried out under conditions of prolonged, forced production. If the operator is satisfied because he has not had to make troublesome changes and repairs, if the owner is satisfied because he has made a good profit from the operation of the plant with the promise of further unbroken service, and if the designer is proud of his plant because of its dependability, simplicity of design, cheapness of first cost, and the lack of kicks from the owners and operators, it can be said the plant is exceptional. Such a plant is in production at Lannan, Wisconsin, and has just completed a year's run for the Lannan Sand and Stone Company.

Milwaukee is the market for a great many sand, gravel and crushed stone producers whose plants are located within a radius of forty miles from the center of the city. Some ship by rail, while others deliver direct to the consumer from their pits. Most of the pits located close enough to take advantage of truck deliveries produce a large percentage of fine sand which has to be taken out if the material is to be used on a first-class concrete job. Those shipping by rail find freight rates high and that trucks have to deliver the material to the job after handling it from the cars.

Dragline Working In Cut



General View of Screening Plant



Conveyor Belt, Scalper, Return Conveyor and Part of Bucket Elevator

An exceptional deposit of sand and gravel was brought to the attention of the men who later incorporated the Lannan Sand and Stone Company. After looking over the field carefully and making exhaustive tests of the deposit, they incorporated as a company and purchased 40 acres near the town of Lannan which is located on a concrete state trunk highway and is 15 miles northwest of the center of Milwaukee.

The deposit is a small hill formed by the recession of a glacier which once covered Wisconsin. It grades from coarse sand up to 6-inch boulders with occasional large stone. The absence of fine sand increases the value of the deposit because of the large percentage carried by the deposits close to Milwaukee and consequent cheap price for the fine grades. No stripping is required.

Their delivery problems were solved by the marketing of a new, fast, heavy-duty, light truck by the Mack Company. This truck is equipped with six full pneumatic tires and is able to make from four to five deliveries per day carrying 4½ cubic yards of sand

Scraper After Dumping on Grizzly

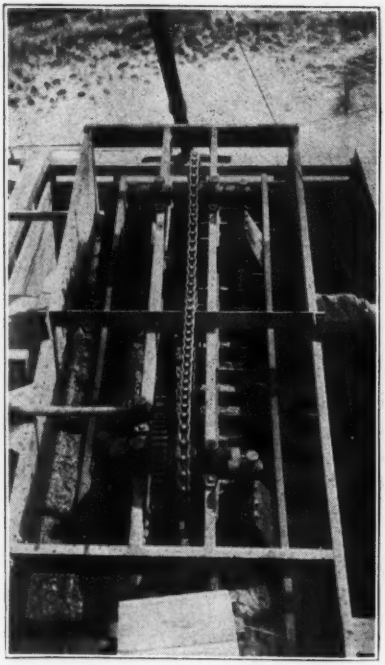
or gravel. To make these trucks more efficient, they were equipped with the Heil hydraulic hoist and special Heil dump bodies were installed. Twelve of these trucks are in steady delivery service while extra trucks are hired to make deliveries during periods of peak demand.

Walter Lippmann of the Lippmann Manufacturing Company of Milwaukee was entrusted with the design and erection of the production plant in which he has incorporated several machines designed and manufactured by himself for sand and gravel plants. The plant was designed to more than meet the owners' requirements of 500 cubic yards in 10 hours. Production has been up to as high as 700 cubic yards in that time which has proven the capacity claim of the designer.

A Sauerman 1½ yard drag line bucket excavates the material from its native bed and hauls it to and discharges it onto a grizzly constructed over a large hopper. A Thomas 2-speed electric hoist operated by a 150 h. p. General Electric motor has been installed to operate the Sauerman drag bucket. The large capacity was specified so that a 2½-yard bucket could be installed if desired.

A Lippmann reciprocating plate feeder discharges the material from the hopper onto a 24-inch inclined conveyor belt. The conveyor belt operates on Link-Belt conveyor rolls on an incline of 4 inches to the foot and has a center to center distance between pulleys of 41 feet.

Discharged from the conveyor belt directly into a 40-inch x 12 foot revolving screen with 2-inch holes, the material requiring crushing is sorted from the fines. The larger pieces are discharged directly into an Allis-Chalmers number 5 Gates crusher which discharges directly onto an 18-inch inclined conveyor belt that carries the



Overhead View of Sand Classifier

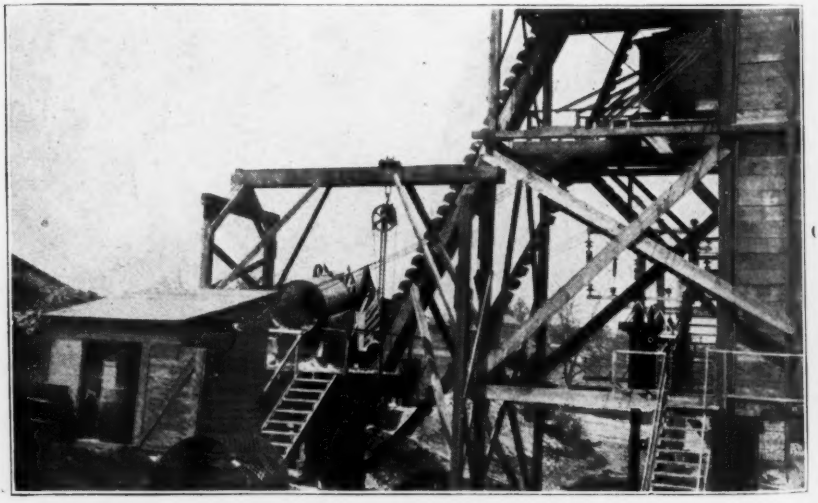
Drawing Off a Load of Sand

Discharge End of Scalper

crushed rock back along the larger belt conveyor to a point where it flows by gravity onto the first mentioned conveyor and is carried with the raw material into the scalping screen previously referred to.

The material that passes through the perforations in the scalping screen is chuted to a continuous bucket elevator which elevates the sand and crushed rock to the top of the bins. The discharge from the bucket elevator is directly into a 48-inch x 24-foot revolving screen that washes and classifies the material. A 6-inch pipe with many small perforations has been placed in the center of the revolving screen and continually sprays the material with water. The first eight feet of the revolving screen is enclosed so that the water will saturate the material before passing onto the first perforated screen. The first perforated section of eight feet has seven-sixteenth-inch holes for the passage of sand and the water which carries off the dirt in suspension. The next four-foot section has seven-eighth-inch holes and the last four-foot section of the screen has one and one-half-inch holes which with the rejects gives three grades of gravel: 2 to 1½, 1½ to ¾, and ¾ to ½ inch. In the largest size part of the material is natural gravel and the rest crushed rock. These three grades fall directly into their respective bins below the screen.

The water carrying the sand and dirt in suspension is led in a trough to a 48-inch x 12-foot Lippmann duplex sand classifier. This classifier forces the sand up an inclined trough and discharges it into the bin below while the dirty water flows out the lower end to be discharged at some convenient point. The forcing action is provided by two sets of paddles attached to their respective frames



View of Scalper, Crushing and Elevating Arrangement

which gives a circular motion to each paddle as the frame follows around the wheel to which each end of the frames are fastened. Adjustments provided allow a close selection of the finest particles to be retained in the product.

The bins will hold 800 cubic yards of sand and gravel. They are of wood on concrete foundations. Twelve undercut gates, two in each of the six loading runways under the bins, provide a means to draw the material from the bins by gravity directly into the trucks spotted below. A special feature of the spouts from the gravel bins is a water jet placed so that a spray of water is directed into the material as it flows from the gate down a chute. This chute has a false bottom of screening, allowing the water to carry off any small particles that might be in the gravel. This rinsing water is caught in a trough and led to a point past the side of the loading truck.

Water for washing the sand and gravel is furnished at the rate of 600 gallons per minute by a Fairbanks-Morse 4-inch centrifugal pump, direct connected to 25 h. p. split phase Fairbanks-Morse motor operating at 1800 r. p. m.

A 15 h. p. motor operates the two conveyor belts and the reciprocating feeder and the scalping screen; a 40 h. p. Howell motor operates the Gates crusher, a 35 h. p. Wagner motor operates the bucket elevator and the large classifying revolving screen, while the sand classifier is operated by a 15 h. p. motor. Electricity is brought to the plant at 26,000 volts pressure and stepped down to 220 volts by outside pole transformers.

Another View of Screen

Ground storage has been provided

Bucket With a Heavy Load

by a large level area convenient to the plant where a large quantity is placed for reclamation when the weather is too cold for operation of the washer plant. A portable inclined belt conveyor is used for loading trucks from this ground storage.

The officers of the Lannan Sand and Stone Company are Frank Schneider, president; H. M. Nugent, vice-president, and S. S. Thompson, secretary and treasurer.

Characteristics of Diatomaceous Earth

Diatomaceous earth, when pure, is usually white, but may be dark colored from the organic matter that has not yet disappeared, states C. E. Davis, in Serial 2718, recently issued by the Bureau of Mines. Impurities may cause the material to have any one or more of a variety of colors such as gray, brown, pink or green. Due to its method of formation, diatomaceous earth is usually soft, very friable, and of low apparent density, being filled with billions of microscopic air cells, but due to various geologic conditions a single deposit may contain all graduations from a loose mass to material which has been altered to hard compact flint. Over 4,000 different forms of diatoms have been classified and although many of these forms are extremely small, a magnification of 200 to 500 diatoms shows that the skeletons give the appearance of having been elaborately carved and ornamented with delicate tracings. A few diatoms are as large as the head of a small pin, but the great majority are microscopic. Each skeleton consists of two exact counterparts fitting one upon the other like tiny pill boxes, and the shape, size and conditions of these particles give to diatomaceous earth the physical characteristics that determine its commercial application. Among the important physical properties are: extreme porosity, making of the material an excellent filtering medium and a poor conductor of heat and sound, and giving it high obsorbent power, to which decolorization, clarification, and detergent effects are due; the large surface affording a support for catalysts; innumerable minute enclosed air cells, which remain intact on reduction of the mass to a powder, the angular nature of the diatoms, their weakness and low compressive strength, making it an abrasive which does not scratch.

New Incorporations

Carolina Holding Corporation,(building materials) Capital $10,000. Incorporators: P. D. Santina, C. Carraro, H. Paladini. (Atty. W. F. Halleran, Jr., Flushing, N. Y.)

West Texas Builders Supply Company, Abilene, Texas. Capital $10,000. Incorporators: Guy McCarthy, J. M. Hooks and M. K. Houston.

East Liverpool Sand Co., East Liverpool, Ohio; 2,500 shares, no par value. Incorporator: George E. Ross.

The Maine Gypsum Corporation, Calais, Me. (mining, quarrying and manufacturing) 500 shares common stock. Incorporators: Ben Y. Curran, James Gray, and George A. Curran.

O'Donnell Brothers, Medina, N. Y., (building materials) capital $150,000. Incorporators: F. W. O'Donnell, L. B. O'Donnell and A. M. O'Donnell. Atty. J. L. Sheldon, Jr., Medina, N. Y.

West Penn Sand & Gravel Co., Wilmington, N. Y. (Produce and sell sand and builders' supplies) Capital, $200,000.

Silica Company of California, Inc., Wilmington, N. Y. (Dealing in silica, asphalt, clay, etc.) Capital $250,000.

Scio Properties, Inc., Rochester, N. Y. (Buy, sell and deal in real estate and building materials.) Capital stock $60,000. Incorporators: William McFarlane, 1600 Highland Avenue, and Clarence F. Grabb of Fairport, N. Y. Attys. McFarlane & Harris, Union Trust Building, Rochester, N. Y.

The Arkhola Sand and Gravel Company, Fort Smith, Ark., Capital $100,000. Incorporators: R. B. Hudson, John Northum, and E. M. Douthat.

Gibralter Cement Products Company, Indianapolis, Ind. Capital $60,000. (Manufacturers of cement and concrete articles.) Incorporators: John G. Praed, Dick Miller and Flora Wittlin.

Chimney Rock Quarries, Chimney Rock, N. C. Capital $100,000. Incorporators: W. E. Graham and N. B. Graham of Mt. Ulla, N. C. and J. F. Mulligan and E. M. Mulligan of Cleveland, N. C.

Asphalt Products Co., Newark, N. Y. (deal in asphalt, etc.). Capital $100,000. Incorporators: H. Theodore Sorg, Dorothy Perkins, Kathryn Wirth. (Attys., Burnett, Sorg, Murray and Duncan, Newark, N. Y.)

Blue River Sand and Gravel Company, Irving, Mo. Capital $20,000.

Lime in Earth Roads

By H. W. Wood, Jr.

Highway Department, National Lime Association*

THE investigation of the action of lime on road soils was started about two and a half years ago by the National Lime Association cooperating with the University of Missouri, and by the United States Bureau of Public Roads cooperating with several state highway departments. This investigation has consisted of laboratory work, together with actual field tests, and while the experiments are not yet completed, several things have been discovered which might be of interest here.

In making the lime treatment hydrated lime is thoroughly mixed into the road soil to a depth of six inches by plowing and discing. To obtain the best results the road should be quite dry when the treatment is made, in order to get an intimate mixture. The road is then dragged to the proper cross section and opened to traffic which quickly packs it.

Lime treatment greatly stabilizes heavy clay and silt soils. These soils immediately lose their stickiness and extreme plasticity, becoming granular in structure, which renders them capable of sustaining normal traffic loads without failure when wet.

Up to this point we have been well satisfied with the success of the lime treatment, but lacked a practical test to guide us in making recommendations.

In order to determine this stabilizing effect accurately a series of investigations was conducted at Ohio State University under the supervision of Professor Eno to devise a test for measuring the stability of soils in the laboratory. The soils to be tested is placed in a steel cylinder 3 inches in diameter and is forced through a 1½ inch hole in the bottom by means of a plunger, the load being applied in a universal testing machine.

When the soil holds a definite percentage of water, the load required to force the soil through the hole is a measure of its stability, or its resistance to deformation under load.

On several clay soils tested by this method a lime treated soil holding 30 per cent of water showed twice the stability of the untreated soil holding only 25 per cent of water. In view of the fact that most clay soils fail under traffic when holding about 25 per cent of water, an increase in their stability in this range of wetness may often prevent a failure of the road. It will be seen that there the untreated soil with 25 per cent of water would fail under traffic, while the lime treated soil containing 5 per cent more water would remain smooth and unrutted. That is exactly what we found in the actual field tests.

There are several practical uses for lime treatment of soils. On a back road in the country, where the traffic is not heavy, and where a hard surface road would be too expensive, it seems advisable to treat the troublesome clay sections with lime. By thus keeping these sections hard and firm at all times, many miles of road will be kept open to traffic in rainy weather and after the spring break-up.

Where traffic is heavy enough to warrant a better road, the subgrade may be treated with lime and the surface covered with a thin layer of crushed stone or gravel. Without the lime this thin layer of surfacing material would soon sink into the clay and disappear but with the increase in stability and loss of plasticity due to the effect of the lime, the thin layer of gravel or crushed stone will remain on top. This will result in a saving of 5 or 6 inches of gravel or stone.

It is often a great help to use lime around a construction job or on a farm to dry up mud holes or to prevent them from forming. Hydrated lime can be strung along the tracks and the trucks will work it in.

Maintenance on a lime treated road is simplified in several ways. (1) The soil loses its stickiness and is not picked up by the wheels of vehicles, to fall on the road and form clods. This keeps the road from becoming rough. (2) The increased stability of the soil prevents the wheels of vehicles from cutting ruts after the surface begins to dry. (3) The lime treated road dries out faster and can be dragged many hours sooner than

* Prepared for presentation before the Eighth Annual Convention, National Lime Association, June 8-11, French Lick, Indiana.

the road without lime. (4) The treated soil mulches more easily under the drag, making it easier to obtain a smooth riding surface.

Another possible use of the lime treatment is in connection with aviation landing fields. When a new field is established there is generally some grading to be done and this leaves the clay exposed. It is believed that a shallow lime treatment will eliminate the stickiness of the soil in these spots, allowing it to remain in place, undisturbed, when planes taxi over it, thus facilitating the growth of grass. The lime will also act as a fertilizer in promoting the formation of sod. We are contemplating such a test on the air port in Cleveland, Ohio, this summer.

Test roads are being built in Wisconsin this summer using a thin gravel surface over the lime treated subgrade. This work will be done by the Maintenance Section of the Wisconsin State Highway Department.

The University of Illinois is building several test sections near Champaign this summer to determine the value of lime treatment preparatory to oiling earth roads. It is expected that the lime will stabilize the soil, and at the same time prevent the emulsifying of the oil by the clay. Both of these should lengthen the life of the oiled surface.

In Missouri and Virginia sections are being treated with lime to obtain further information concerning its use on earth roads without the addition of any surfacing material. In Ohio another short section of subgrade for concrete pavement has just been completed, and the tests in the laboratories at Ohio State University are progressing. With the results of all these tests compiled, together with the results already obtained in previous tests, definite recommendations for lime treatment of earth roads, subgrades, and landing fields can be made.

This project has now been brought out of the experimental stage, for the new test will enable us to recommend the amount of lime required on any soil. With some knowledge of local conditions as to grade, location and drainage, we can tell how deep the treatment should be.

Bucyrus Announces New One Yard Shovel

The Bucyrus Company recently announced a new one-yard, full-revolving steam shovel for contractors and general use.

Speaking of this new Bucyrus, G. A. Morison, vice president and secretary of the company, says: "Close contact with shovel users in the field has shown that the excavating tool most in demand today is a one-yard shovel with very definite qualities; accordingly, we have built the 31-B to meet these conditions. The over-all dimensions of the shovel are no greater than those of most ¾-yard shovels built today but this new Bucyrus is a real 1-yard shovel, built from caterpillar track to boom sheave for work with a one-yard dipper. Thus built, the clearances of the shovel are such that it can maneuver in and out of odd corners handily and work to advantage in extremely narrow cuts. The rear end radius is just 9 feet 6 inches. This with the strength for any sort of digging on any job that a small revolving shovel might be reasonably asked to do and the dipper capacity of one cubic yard will, we believe, make the 31-B a most efficient tool for general excavation.

"The standard machine is built to cut a wide, level floor 16 feet, 7 inches, dig 4 feet 11 inches below grade and dump 12 feet 6 inches above the floor level, either to spoil or in trucks. It has, of course, the abundant strength and power that has always characterized Bucyrus machinery.

"All of the proven Bucyrus features are retained in the design, which has been worked out in close co-operation with men in the field, including the outside dipper handle, the box girder boom, two part hoist, direct connected to dipper, unobstructed dipper opening, swing engine mounted in front and the Bucyrus caterpillars with big idlers and bearings high out of the mud and the continuous treads with no gaps between links.

"The shovel is also available as a high lift shovel of 1-yard capacity, dumping 18 feet above the floor and extra high lift, ⅞-yard dipper that reaches its extreme dumping height of 21 feet 7 inches.

"The 31-B is quickly and easily convertible to a dragline, with a 40-foot boom. It is also offered as sewer excavator, clamshell or crane."

Complete Transportation Facilities Aid New England Cement and Lime Company

DETAILS of the new lime and cement plant at Rockland-Thomaston, Maine, were described in the May 1st number of Pit and Quarry and announcement was made that the lime plant was nearing completion and would be in operation next month.

The New England Portland Cement and Lime company owns 20 acres of shore property at Rockland, one of the finest harbors along the Atlantic coast. The deepest water in the harbor, 25 feet at low water, lies off this property. Tracks of the Maine Central Railroad run through the properties adjacent to the lime and cement plant, so advantage may be taken of both water and rail transportation.

All manufacturers of lime as well as other commodities recognize the advantages of low cost production. Unfortunately, in the past, high quality of product, as a necessary complement to low cost, has not been so generally recognized in the lime industry as it might be. In fact some plants have worked their deposits out to a point where it is scarcely possible to maintain quality, and still they have gone on in production, working material that is not up to the standard of quality, to the great injury not only of themselves but also of the entire industry.

New plants, starting on virgin stone deposits of high quality, with modern appliances often have a great advantage toward obtaining both low cost and high quality together, providing their work is well planned and equipment and methods well chosen. In order to maintain their strength in the industry, many of the best managed older producers have resorted in the last few years to the plan of abandoning and charging off old plants and equipment, in some cases almost entirely, and rebuilding as well as replanning and revising their operating methods to meet modern conditions.

In many cases, however, this has been poorly or only half done, with only limited improvements and in still other cases it has been a hopeless task, sometimes because of the expense involved, and in several instances because of quarry conditions where depletion, or poor development policies in past years have made the task not worth while.

There is no denying that quality and adaptability for its intended use, has been given a great boost in the lime business in the last few years. Neither is there any doubt that inability of many manufacturers to meet these quality demands has caused the abandonment of many quarries and plants, and will continue to cause more and more abandonments in the future. The same process has caused the starting of several new plants where conditions for cost and quality are favorable, and will continue so to do in response to the laws of supply and demand. In several actual cases at this time it is a well-known fact that new high quality standards from modern plants are obtaining market prices considerably higher than the current general price in their territories, and this at an even lower selling expense than the lower qualities demand.

These present fixed tendencies of the industry, which cannot but be considered sound and permanent, have been the underlying guide that has been kept in mind and referred to constantly in the laying out, designing and planning of operations in the new plant of the New England Portland Cement and Lime Company at Rockland and Thomaston.

Generally speaking, with proper planning and operation, quality does not add to manufacturing cost. This has been proven repeatedly in the lime industry, and in many cases it materially decreases these costs. It invariably reduces selling costs and often much more than pays for the entire selling expense in increased selling values.

Manufacturing costs in the lime industry are made of three general heads, i.e.

1. Cost of stone delivered in the kilns.
2. Cost of fuel.
3. Labor burning and handling to the cars.

In general stone cost is mostly influenced by

a. Actual cost of quarrying.
b. Waste.
c. Transportation to the kilns.

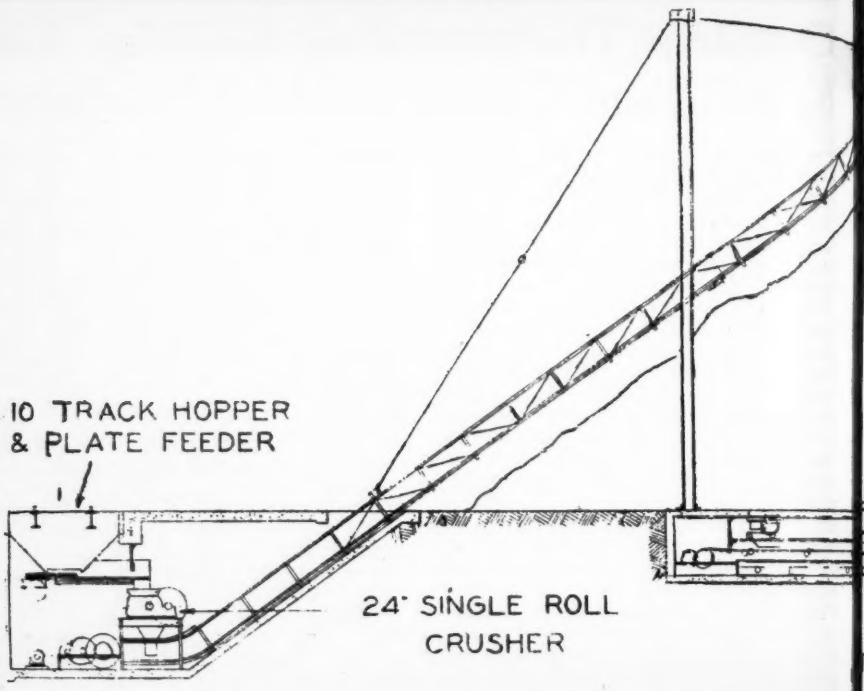
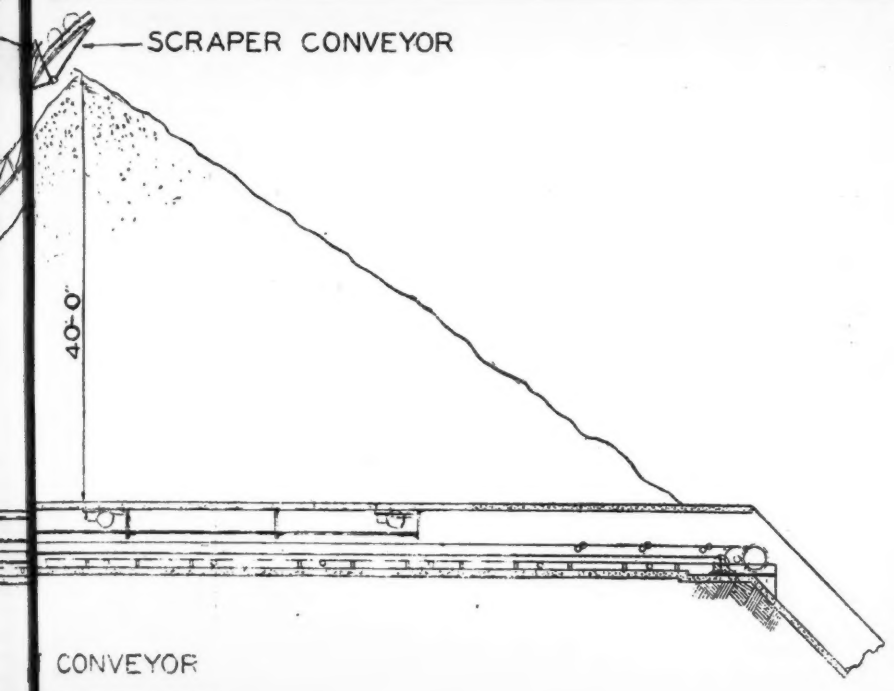


Diagram Showing Ar

Airplane View of Quarry of Rockland-Thomaston



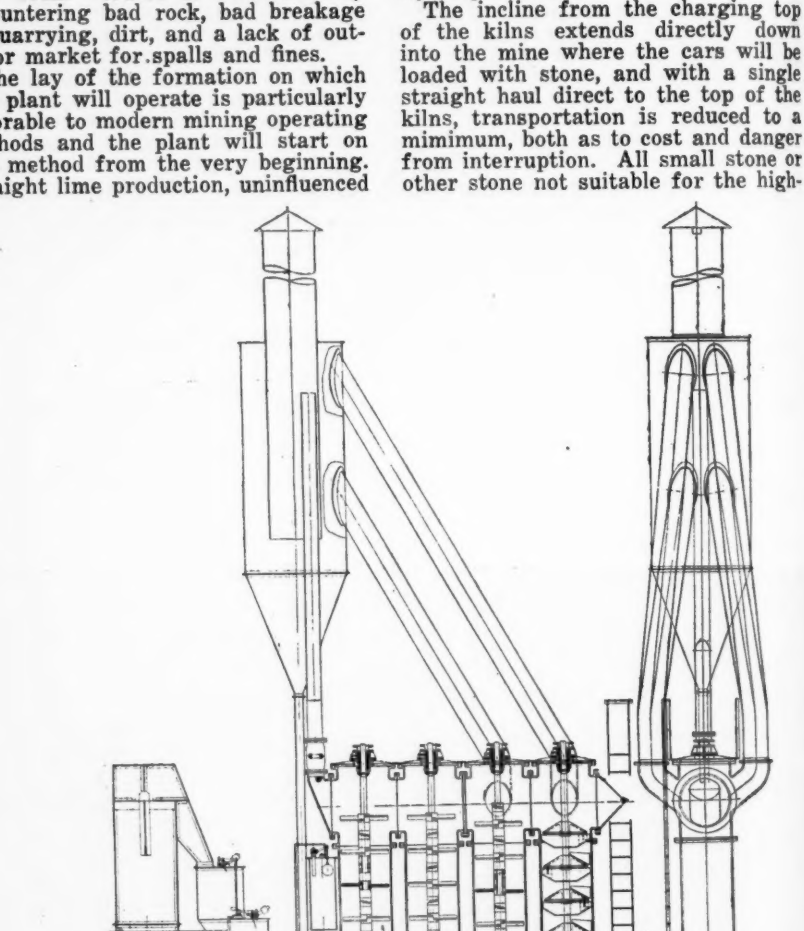
Coal Storage System

England Portland Cement and Lime Company

Actual quarrying cost is greatly influenced by the effects of either straight lime production or spasmodic operation on account of weather or other interferences, and also by overburden and encountering of veins of poor rock. Waste is influenced by encountering bad rock, bad breakage in quarrying, dirt, and a lack of outlet or market for spalls and fines.

The lay of the formation on which this plant will operate is particularly favorable to modern mining operating methods and the plant will start on this method from the very beginning. Straight lime production, uninfluenced by weather, entire freedom from stripping and dirt, as well as the possibility of selecting only good stone, will be taken advantage of as an insurance of both economical and regular stone supply as well as high quality of product.

The incline from the charging top of the kilns extends directly down into the mine where the cars will be loaded with stone, and with a single straight haul direct to the top of the kilns, transportation is reduced to a mimimum, both as to cost and danger from interruption. All small stone or other stone not suitable for the high-



SCHAFFER SUPER HYDRATOR

est grade of lime manufactured will go directly to the cement mill rock pile over the same incline and car system. This will eliminate all stone waste from the mine.

Delivery of coal by water has been a practice in this territory for many years, and is more reliable and of lower cost than that of many inland plants almost adjacent to the coal fields. Its handling at the plant is unique. It is handled by a Jeffrey coal handling installation, first to a storage pile in crushed form, and then by conveyor and chute, down into the mine shaft entry. From there, by way of the regular stone transportation system it goes to a bunker between kilns and feeds to the automatic stokers by gravity and a regular weigh larry installation. The handling throughout is done without any extra men and provisions are made so as to avoid any possibility of freezing or clogging or fires from spontaneous combustion. The equipment has a capacity of 25 tons per hour and consists of the following units: track hopper, plate feeder, single roll crusher, scraper conveyor and belt conveyor.

Lumps of coal 16 inches and under are discharged from hopper bottom cars into the track hopper which is 10 feet by 10 feet in plan, and has an approximate depth of 5 feet. The hopper is made of one-quarter-inch steel plates. An adjustable regulating gate is bolted on at the bottom for increasing or decreasing the size of opening to the feeder. A 10 x 10 inch mesh bar grating is also installed. A Jeffrey standard reciprocating plate feeder takes the coal from the hopper to the crusher, at the rate of 25 tons per hour. The feeder skirts are 24 inches high, and are made of three-sixteenth inch steel. The reciprocating plates are of three-eighths inch steel, and mounted on four single flanged rollers supported by suitable brackets from skirt plates. The reciprocating plates are actuated by an eccentric arranged with an adjustable stroke for regulating the capacity.

The eccentric shaft is two and seven-sixteenths inches diameter and is supported by suitable steel from the feeder, making a self-contained drive. The eccentric shaft is driven by "Reliance" chain from the crusher roll shaft, and has a jaw clutch for stopping the feeder at any time.

The crusher is a standard Jeffrey, 24 x 24 inch, single roll, complete with shearing pin and safety devices, and receives 16-inch lumps and under at the rate of 25 tons per hour and crushes to 1½ inches and under. A steel hopper chutes the coal to the scraper conveyor. This has 103 feet centers, eight feet on horizontal and 95 feet on an incline of 35 degrees, operating at a speed of 100 feet per minute, with a capacity of 25 tons crushed coal per hour.

It is made up on 18 x 1 x ¼ inch steel scrapers, spaced at intervals of 24 inches between two strands of Jeffrey malleable roller chains. Standard rock and pinion valves are used for intermediate discharge from the trough.

A belt conveyor with 93 feet horizontal centers, operating at a speed of 225 feet per minute, and having a capacity of 25 tons per hour operates under the coal storage. It receives coal by means of an opening valve at the bottom of the storage and delivers to a chute.

The belt is 14 inches wide, 4-ply "Century" brand, with one-sixteenth inch rubber cover on carrying side. The troughing idlers are standard 3-pulley type mounted on wood base boards, spaced at intervals of five feet. The return idlers are of the side hanging type to be spaced at intervals of 10 feet. All idlers have fittings for high pressure lubrication.

The burning of the lime is done in Schaffer semi-automatic kilns with extra large preheating chambers and extra large cooling chambers. These kilns are fitted with four specially designed automatic stokers to each kiln with a very accurate clock-regulated mechanism governing the speed of the stokers in such a manner as to assure a uniformity of firing continuously. A complete pyrometer equipment on each kiln together with a continuous gas analysis machine changes the entire burning process from a manual labor job to a complete mechanical one. This eliminates the variables that always occur where the human element is in control and substitutes mechanical accuracy. The so-called lime burner is replaced by a combustion engineer whose work is of a laboratory type rather than that of a skilled common laborer. One man with a laborer for an assistant to help make adjustments when necessary can operate several kilns at one time with perfect ease. Recording instruments showing tempera-

tures and gas analysis throughout each twenty-four hour period show an unquestionable record of what is going on inside the kiln, thus permitting the operator to see trouble approaching before it arrives and make corrections ahead of time as well as allowing the executives to have reliable check on the operators' records and place responsibility without danger of error. The effect of this method of operation is obviously a big factor in both cost reduction and quality control.

The kilns being of the slip type rather than the sticking type are drawn through large gates in the bottom of the cooler. These gates are opened and closed by hydraulic cylinders controlled by switch from the firing floor. The draw of the kiln being through two gates operated separately permits the operator to balance his kiln perfectly.

This plant, being designed primarily for the production of the highest quality of lump lime for the barrel trade, has adopted the system of hand selection as the only positive method of securing a properly graded product of this kind. Ample barreling and storage space directly adjacent to the outgoing railroad line is provided on both sides of the kilns on the picking floor level.

At this same point the selection of lime for hydrating is also done by hand. The hydrating department will be built around one of the new Schaffer super hydrators with provisions for two grades of hydrate differing in quality and each adaptable for a separate purpose. The hydrating department being the last part of the plant to be installed is not yet complete and its further description will be delayed until more can be definitely said regarding its operation.

The preliminary development of this enterprise has been undoubtedly the most thorough and important ever known in the lime or cement industry under the supervision of engineers of national reputation. The ground plans for a cement plant of initial capacity of 3,000 barrels daily have been completed and construction is to be started when the lime plant is in operation.

Mammoth Cave Rock Asphalt Co., Wilmington, N. Y. (mining). Capital $1,500,000. (Corporation Service Company.)

Production of Phosphate Rock Is on Increase

The total quantity and value of phosphate rock mined in the United States and sold in 1925 were 3,481,819 long tons, valued at $11,545,678, according to a statement made by the Bureau of Mines, Department of Commerce, which was compiled from individual reports furnished by producers. The figures indicate an increase of 21 per cent in quantity and of 13 per cent in value as compared with 1924.

The following table shows the quantity and value, by states, of the various kinds of phosphate rock mined in the United States and sold in 1925:

State	Long tons	Value
Florida:		
Hard rock	378,692	$1,448,526
Land pebble ..	2,551,272	7,340,544
	2,929,964	$8,789,070
Idaho:		
Western rock..	65,934	289,498
South Carolina:		
Land rock	2,147	8,051
Tennessee and Kentucky:		
Blue and brown rock	477,077	2,429,059
Wyoming:		
Western rock..	6,697	30,000

Imports of phosphate rock in 1925, which were 2,735 long tons, valued at $37,932, indicated a decrease of 83 per cent in quantity, and of 79 per cent in value. Exports amounted to 922,655 long tons, valued at $6,559,360, an increase of 13 per cent in quantity and 28 per cent in value.

Silica Investigation

Probably no other mineral has more diversified uses, or is of more value in industry and the arts, than silica in its various forms. It is the most abundant mineral compound in the world, and every state in this country produces important quantities. The Bureau of Mines has completed a study of this exceedingly useful mineral in all its phases, including quartz, sandstone, sand, diatomaceous earth, pulverized silica, tripoli, and special sands for chemical, metallurgical and other uses. Data were obtained on the mining, preparation, and utilization of these various forms, with especial reference to economy and efficiency in production, and the elimination of waste. A bulletin giving the results of the investigation will be published at a later date.

Opportunities in the Industrial Field

L. B. Burt

Manager, Industrial Department, National Lime Association*

SPEAKING from the standpoint of field activities in the broadest sense the opportunities for lime promotion are wonderful although not entirely sanguine. From the standpoint of the lime manufacturer some of the features classed as opportunities for field work by an association man would more properly be classified as urgent necessities. But the latter distinction is for the manufacturer to determine and we shall confine ourselves here with the work in hand as the function of an active promotional organization.

We must look to our fences at all times. There are active sales organizations whose efforts tend to displace lime and who have easy sailing because they meet with no resistance from the lime industry. There is need for keeping in touch with uses that are supposedly well established because there is no way of guessing when an important development may seriously effect the status of lime. There is need at all times to push the frontier forward by uncovering new applications, fostering and helping new and efficient methods of its introduction in industry.

The application of lime in an industrial process is not mixed with sentiment. It is used only so long as it is the most economical, or indispensable material. As compared with any other chemical possessed of like properties, it has economy heavily in its favor, but that is not always the prime consideration. There are cases conceivable where lime may be displaced by other means, plus salesmanship. The combination, while not formidable, calls for combat. To offer no opposition is to surrender. To be specific, in the sulphite pulp industry the Jennsen limestone tower has made heavy inroads in lime tonnage. If there had been properly directed effort that could show without much difficulty that the milk of lime system operates at no greater cost than the tower, the cost of installation of towers would have acted as a powerful argument against the change. But no such work was in the field and the towers lifted their heads all over the paper pulp sections. As a matter of fact, being on the defensive is better strategically, but the lime tonnage so lost went without a struggle.

Defense against such inroads must be built up to suit the case. Consider the frontal attack via the soda and sulphate pulp mills. The arguments seem pretty strong as they are presented by the makers of the sludge reburning equipment. Savings are claimed on the score of lime cost, labor saving said to be effected by an automatic continuous causticizing plant, furnishing white liquor continuously instead of intermittently, and the solution of the stream pollution difficulty, a subject actively before all state boards of health. The estimated savings indicate a justifiable investment. There we have a problem facing us squarely and there is no dodging of the issue. If that were the whole story it would be our cue to strike our ten and decamp as gracefully as possible. But there are some things with which we can make the enemy slow up and we shall consider these now.

Reburning of sludge requires a dewatering and filter pressing operation ahead of the burning. The burning itself, according to dependable information, is carried on at a costly fuel ratio, much higher than lime manufacturers could stand, and the product obtained is progressively lowered in quality due to the constant accumulation of impurities with each reburning. Labor saving credited to the continuous causticizing is purely a mechanical improvement which can be gained independently of the reburning. Two manufacturers are carrying on experiments of dewatering and sludge removing apparatus that hold interesting promise. As for sludge disposal polluting public streams, there is already in commercial operation a profitable means for converting the sludge into a high grade paper coating material which should be much more attractive from a business standpoint than inferior lime.

This indicates one of the big op-

* Presented before the Eighth Annual Convention, National Lime Association, June 8-11, 1926, French Lick, Indiana.

portunities for field work, and perhaps an urgent need on the part of the lime manufacturers. A recent flurry in the straw paper field was caused by a group of strawboard mills that combined in the support of some research work started at the Forest Products Laboratory and continued in an especially equipped laboratory at Quincy, Illinois, to displace lime with a sweeter smelling cooking medium. To be more nearly correct, the product they aimed at was intended to overcome the livery stable odor in cold storage eggs. They have met with discouragement thus far but we have good reason to see that the failure was due to its excessive cost rather than to any lack of intelligence exercised in the lime using methods extant. There is need here to look to our fences. It may seem that a disproportionate amount of time is devoted to the subject of paper, but paper consumes more lime than any other single product in the industrial field, with the possible exception of steel. However, much of the lime used in metallurgy is produced by the users. Before leaving the subject of paper, it would be interesting to run down the reasons for the switching of rag cooking from lime to soda. In the abstract it does not seem logical that it should be a saving to buy caustic soda instead of lime and then run the spent soda into the sewers.

Along the same line it is our business to learn why all soap makers excepting two or three very large ones it is cheaper to buy fresh caustic soda than to recausticize with lime. Perhaps this is overlapping on the province of the Research Department but a certain amount of overlapping is necessary for effective cooperation. Overlapping in discussion protects against overlapping in field research and field promotion.

The subject of lime in glassmaking is best discussed "in lodge." To drag a glassmaster out into the open for a frank discussion of costs is a job in itself. To find one that will admit there are other cost factors entering into it than lime versus limestone is another job. But this much is certain; while they will not concede a thing about the importance of color, yield, fuel, or control, a regular campaign insisting upon those claims cannot fail to bring returns.

It seems good to find a sector that is safely ours. The leather industry comes pretty close to being that. At times we encounter a substitute for lime in the dehairing of hides, particularly sodium sulphide acid under a trade name. This material destroys the hair and it does not plump the hides as well as lime does. Hair has a market now, hence the competition is not serious in that field.

Since learning that the high phosphorus iron in the Birmingham district is made into open hearth steel with a maximum phosphorus content of 0.02 per cent by means of fluxing with burned lime, we feel more strongly convinced than ever that burned lime should be advocated as flux in all open hearth furnaces for steel making. While the largest steel makers run large lime plants to supply their own needs, many steel plants not large enough to warrant such measures are good prospects. However, they can only be converted after real trial runs in their own furnaces. In urging trial runs it must be insisted that the furnace be run at capacity with each type of flux, the heat drawn when ready rather than at equal lengths of time. The time factor should be the determining economic consideration, while the degree of refinement should also be noted. Subsequent rolling properties are also better when lime is the flux. That seems to be the most important possibility for gaining lime tonnage in the steel industry.

Another item that should be heard from as soon as some mechanical details are thrashed out for the crushing of lumps formed as waste at galvanizing vats, will be the recovery of zinc. This will be done by first treating the crushed or ground waste with hydrochloric acid, forming zinc chloride, then with milk of lime, forming calcium chloride and zinc. Work along this line has been attempted in a zinc smelter at Henrietta, Oklahoma, but they failed to get an appropriation from their New York office for a crusher and the attempt lost momentum. It will, however, be carried on.

Water softening has been quite fully discussed at previous conventions. The subject is one that carries with it a strong temptation to go into lengthy enumeration of gains all along the line. As an opportunity it has been exploited by such leaders in the water treating field as Hoover, Bardwell, and others. All we need to add at this time is that it looks better today

than it ever has before. In the past three years municipal water softening with lime has more than trebled. There are plans on the boards today for at least five additional municipal plants and perhaps twice that number projected. On the railroads, installation of new water softening plants is a regular program with nearly all the important systems traversing hard water territory.

There is room for profitable promotion work on 14,000 miles of road, operating over 3,700 locomotives where no softening equipment has been built to date. Work is in progress on officials of these roads and the status varies all the way from total indifference to complete conversion. In the roads listed under the proposed Van Sweringen merger, prospects are among the brightest. In municipal water purification progress is slow compared with the foregoing, but the field is large and while the units of lime consumption are not heavy, based on the million gallon dosage, the aggregate is worth working on. Results obtained at Toledo, Omaha, Quincy, Denver, etc., indicate that a small addition of lime cuts the alum requirement, in half. This carries a strong appeal to all water works and chemists, and although the method seems to be contrary to established flocculating reactions, it seems to do the work at the places named, with all year round consistency and an improved bacterial removal.

Perhaps the most active subject before the national and state health authorities today is the protection of public water supplies from pollution. The treatment of domestic sewage, for the present at least, seems to be best handled by biological methods. To take any other position would be to contradict the entire sanitary engineering profession. But trade wastes are becoming recognized as chemical problems. We are about to witness some real progress along that line, and toward that end we have established friendly relations with the state sanitary engineers of a dozen states. The lime industry can make a worthwhile outlet of this opportunity, the scope of which is hard to estimate.

One very interesting solution along that line is reported from an oil property in Oklahoma. In that case the state authorities complained of the brine discharged into a river. A chemist tackled the problem, the result being a separation of the brine from the oil, evaporation, and a lime treatment, producing calcium chloride and sodium chloride. When completed this plant will produce liquid chlorine, epsom salts and caustic soda. Inasmuch as salt water is commonly discharged into streams from most oil fields in the Mid-Continent states, such a scheme has the possibility of wide application; with a substantial lime tonnage. Active progress of interest to the lime industry is being made in the anthracite coal field, creamery wastes, and tanneries. The opportunities are not even scratched, but as said before, they will be pretty much what we make them. Wherever possible, a waste should be worked into a by-product of some commercial value. The growth of the sand-lime brick industry has much meaning for lime manufacturers. Not enough importance has been attached to this outlet. With an effective organization in the promotional field assigned to construction uses, it would not be amiss to consider pushing sand-lime brick as against common clay. It may seem a bit remote for us to push casein glue, but it should be borne in mind and any opportunities to do so, not wasted. The time is not ripe for opening up on the subject of oil refining, but we hope that before many weeks we shall feel free to plunge into a vast industry that is almost untouched by the purifying effects of lime.

Since it would be impossible to do more than briefly mention a few outstanding subjects in a paper of this kind, the purpose is to define the nature of the work to be done and the scope of the field, and from these to formulate an idea of the talent required. It can be seen that many industries will lead us into consideration of processes, diversity of products and by-products. It is difficult to impart verbally the magnitude of the opportunities in the industrial field, but this much is certain the opportunities are such as warrant and demand real work for their exploitation, by a selected, rounded out personnel, backed up by laboratory and field research and supported by strong publicity work.

The Ebsary Gypsum Company, Inc., is now located in its new general offices at the Newark, New Jersey plant erected at 414 Ogden Street. The New York sales offices at 103 Park Avenue will be retained for the convenience of the New York trade.

New South American Cement Plant Planned

PLANS are being prepared for the construction of a new cement plant at Ariquipa, Peru, to be called the Ariquipa Portland Cement Company. The initial capacity of this plant is to be 600 barrels daily with provisions made for the addition of similar units as required.

Ariquipa is a city of 60,000 in the uplands of southern Peru. The Southern Railway connects it with the port of Mollendo, 80 miles westward. Inspection of the accompanying map shows the great inland territory tributary to Ariquipa through this same railroad.

At present cement is obtained from the Lima Portland Cement Company at the capital city of Peru or imported. In either case it must come by steamer and must be transhipped by barges at Mollendo, loaded on cars and hauled the 80 miles to Ariquipa. Mollendo does not have a protected harbor for ships to lie against the docks and as a consequence they must anchor far out to sea, which necessitates transhipment of all freight. This extra handling, together with the freight haul to Ariquipa, adds so much to the cost of the cement that the ruling price ranges from $10.00 to $12.00 per barrel, with occasional sales as high as $20.00 per barrel.

The Foundation Company of New York has a contract for rebuilding Ariquipa into a modern city. Their first step in the prosecution of this contract was to lease the Lima Portland Cement Company's plant at Lima and double its capacity. They are using practically the total output of this plant in this contract. That the cost of this work is high can easily be seen when noting the cost of the cement.

There is an increasing demand for cement for the construction of dwellings. The ever recurring earthquakes require that the houses be constructed substantially. To construct them of stone requires that the walls be made 2 and 3 feet thick. Thin reinforced concrete walls give the same strength as the massive stone walls in addition to greater rigidity than is possible with unit construction. At present the only drawback to the universal use of reinforced concrete structures is the high price of cement.

It has remained for a Henry Delgado, a native of Ariquipa, who has spent several years in the United States learning the ways of the Americans as well as their industries, to point out to several public spirited citizens of the city of his birth that they should construct a cement plant of their own.

He pointed out that with lower priced cement an immense reservoir would be made economically possible that would impound enough water to irrigate great stretches of the desert land adjacent to the city; that the civic improvements being made could be made at a much lower cost than at present or more improvements could be made for the same expenditure; that a breakwater could be constructed at Mollendo which would allow the construction of port facilities to care for ocean liners without the present slow and costly method of transhipping and that a consequence of this last provision would be the obtaining of all the commerce of Bolivia instead of the 50 per cent now being sent in over the Southern Railway. This, by the way, would help greatly to avert serious trouble with Chile over their common claims to Tacna and Arica, known as the Tacna-Arica dispute, for, with the routing of the commerce of Bolivia over the Southern Railway from Mollendo, the town of Arica would soon be deserted. He also pointed out the present and future demand for cement and the immense saving that could be made to the people as well as profits to the operators of the cement plant.

His investigations showed that large deposits of clay were close at hand, that coal could be mined within a mile, gypsum could be obtained in unlimited quantities five miles from the site and that a supply of lime rock 10 miles square which runs better than 99 per cent calcium carbonate could be obtained at a point 25 miles from the city of Ariquipa. It is proposed to build the plant at Ariquipa on account of the plentiful supply of labor.

As the coal carries some sulphur and will require treatment before use as fuel for cement burning, the initial installation will use oil for fuel. This oil will come from northern Peru by tanker and rail.

Mr. Delgado will soon return to Ariquipa to make final arrangements for construction of the plant and hopes to be able to announce the placing of the order for the required machinery.

Blasting and Market Problem Solved By This Crushed Stone Company

By H. W. Munday

ABOUT one hundred miles east of Kansas City, on the St. Louis division of the Missouri Pacific Railroad at Blackwater, Missouri, is the new crushed stone plant of the Blackwater Stone Company, which was completed in June, 1925. Construction work was started in February of that year.

The plant is in direct line with several growing cities such as Marshall, Boonville, Sedalia, Jefferson City, etc. This plant was erected primarily for the purpose of furnishing crushed stone for the Missouri State Highway Department. The plant location was evidently selected because it could best serve the state highway department requirements. In addition to supplying the large requirements of the state the Blackwater Stone Company is prepared to satisfy the constantly increasing demand for crushed stone in the commercial field and also a heavy call for agricultural limestone.

Previous to the opening of this plant there was but little agricultural limestone used in Missouri, but through the efforts of the sales department of the Blackwater Stone Company and the county farm agents, the state has been sold on the necessity of using limestone dust on the soil. The agricultural market now consumes the entire output of screenings. This agricultural limestone passes through a four-mesh wire screen. Fifty per cent of the product passes a fifty-mesh wire screen. The stone tests 98 to 99 per cent calcium carbonate and is an excellent soil corrector. It is very probable that by 1927 the demand for agricultural limestone will have increased sufficiently to make it necessary to install additional pulverizing machinery.

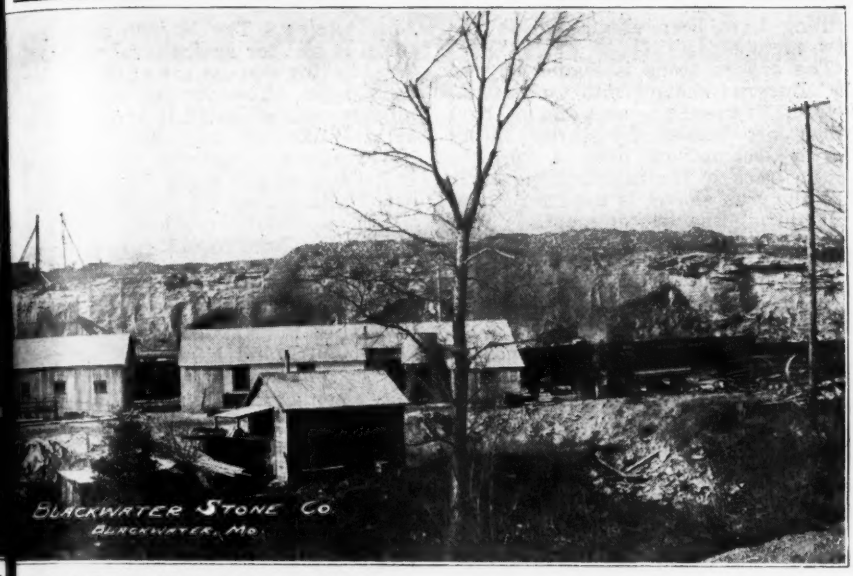
The quarry face extends parallel to the plant and is approximately one thousand feet in length. The average depth is between 45 and 50 feet. The

Storage Bins and Tracks

The Layout of the Plant is Particularly Ad

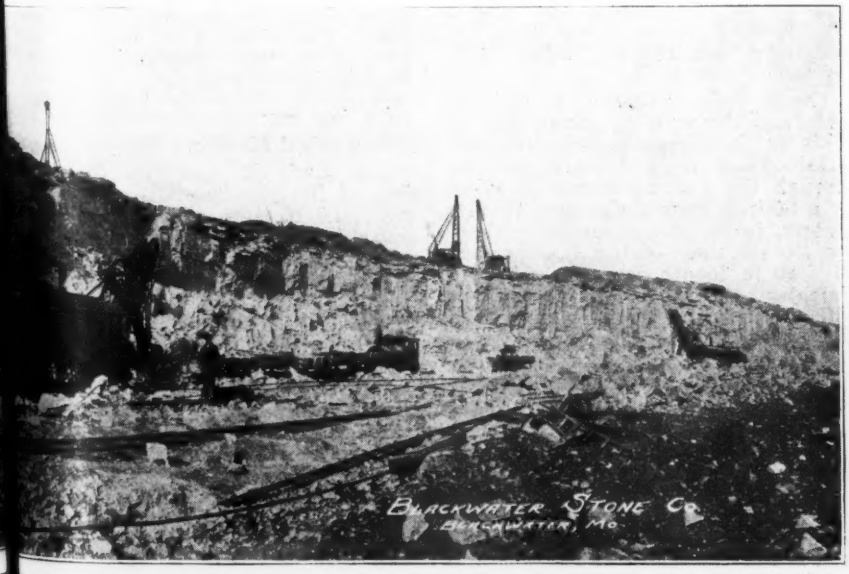
formation is the Burlington limestone of the Mississippian system. Owing to the solid formation of the rock, the regular drilling and blasting methods were found to be unsatisfactory as practically no fragmentation could be secured and expensive block holing had to be resorted to. With the present method a number 14 Sanderson cyclone well drill and a number 26 Loomis clipper well drill are used to put down four-inch holes fourteen feet apart and twelve feet back from the face. Denver model 21 turbo drills are then used to drill holes to a depth of 25 feet between the well drill holes and also between the line of four-inch well drill holes and the quarry face. Du Pont powder, 40 per cent gelatin and durox, is used

Panorama of Long Quarry



y and Efficient Movement of Product

and all the holes are discharged simultaneously. Compressed air is furnished by a Sullivan angle compound compressor with a capacity of 400 cubic feet per minute. When the results of this new method were compared with the old, it was decided to adopt it for future work. The old method called for putting down six inch holes. The new method, employing the smaller size blast hole in connection with the Denver drill holes for the upper 25 feet, permits the explosive to be distributed almost the entire height of the face. The resulting fragmentation is practically a 100 per cent improvement when compared with the six-inch holes. The greater part of the idle time of the shovels and also the considerable secondary



Worked By Company

drilling have been eliminated by the new method.

The broken stone is loaded by two 70C Bucyrus shovels into Continental 4-yard, two-way, side-dump cars which are hauled by three 12-ton Porter locomotives over a 36-inch-gauge track to the crushing plant. A 30B Bucyrus shovel is used for stripping during the winter months. This shovel is equipped with a 50-foot boom and a one-yard Williams clamshell bucket for stock piling and reclaiming work during the operating season.

The initial crusher is a 30-inch Allis Chalmers "McCully" driven by a 150 h. p. Allis Chalmers slip-ring motor. The discharge drops to a 38-inch bucket elevator, 50 feet centers, which in turn discharges to an Allis Chalmers open-end scalping screen, 20 feet long and 60 inches in diameter with 2¼-inch and 1½-inch round holes. The oversize from this scalping screen goes directly to the secondary crushers. There are two of these, one is a number 13 Allis Chalmers "McCully" and the other a number 5 Allis Chalmers "Gates." The first is driven by a 75 h. p. Allis Chalmers motor, while the second is driven by a 40 h. p. motor of the same make. The discharge from these secondary crushers drops to a 24-inch belt conveyor which carries the stone back to the bucket elevator discharging to the scalping screen thus providing a closed circuit. A 75 h. p. Allis Chalmers slip-ring motor drives both the scalping screen and the bucket elevator discharging to it.

The material between 2¼ and 1½ inch from the scalping screen goes to a bin in the screen house. The material 1½-inch and less passing through the scalping screen is taken by a 30-inch bucket elevator, 75 feet centers, to the sizing screens. There are two of these sizing screens each 20 feet in length and 60 inches in diameter and equipped throughout with sections of 1½-inch perforations and a 10-foot dust jacket with 1-inch perforations. A 75 h. p. Allis Chalmers motor drives both sizing screens and the elevator feeding them.

The one-inch to fines material passing the sizing screen is passed over shaking screens. There are two of these: one a Seaverns 5 x 10 foot and the other a 4x14 foot shaking screen made to the Blackwater Stone Company's design. The size between ½ and ¼ inch is separated and sold for top dressing. The ¼ inch down material is sold for agricultural purposes. The shaking screens are of the double-deck type. The various sizes from all screens are chuted to separate bins or are mixed as demanded.

The present capacity of the plant is 2,000 tons per day. This capacity can be increased by installing additional secondary crushers and provision has been made for their installation. Power for the plant is furnished by the Missouri Utilities Company and the 13,000 volts on the power line is transformed at the plant to 2,500, 440 and 110 volts.

The company maintains comfortable sleeping quarters and a dining room for the employees. An eight-room dwelling situated on the highest point of the company property is maintained for the use of the superintendent and other officials who may visit the plant. This house is modern in every respect.

The entire plant was designed by the Allis Chalmers Manufacturing Company. The plant structure, including the bins, is of timber on a reinforced concrete foundation. The bottoms of the bins are also of reinforced concrete.

R. Newton McDowell of Kansas City, Missouri, is president of the Blackwater Stone Company. H. H. Hopkins of St. Louis, Missouri, is vice president. E. L. Miller of Kansas City, Missouri, is secretary. W. J. Brimacombe is general superintendent. The offices of the company are located at 1016 Baltimore Avenue, Kansas City, Missouri.

Mechanical Handling Systems, Inc.

The Cecil R. Lambert Company, Inc., of Detroit—specialists in the design, manufacture and installation of conveying and handling equipment—announces that in order to identify its products and service with its name, that the latter has been changed to Mechanical Handling Systems, Inc. The Company's facilities for service are being materially increased by additions to its plant and personnel, but there is no change in ownership, management or executive staff.

Clifton Reeves, consulting and operating industrial engineers, announce the removal of their New York office from 150 Broadway to 341 Madison avenue.

Substantial and Economical Construction

J. P. Mollenkof

Superintendent of Construction, John H. McClatchy Company*

FIRST of all, I want it understood that I am not connected with any lime company and that the only reason I am using lime is simply because I want to use materials that are best and which I can buy at a price which will enable me to compete with other contractors.

The reason I have selected lime may be because my grandfather used it for mortar in building church steeples, and for stucco 75 years ago around Philadelphia and the jobs are still standing. My father also used straight lime in all his plaster and stucco 45 to 50 years ago and his jobs are still in good shape. Possibly their reason for using lime was that they had no other choice, as cement was out of the question in those days. However, when I look back and see jobs standing for 75 years and more I often wonder why builders waste their time and money experimenting with every new material that comes along, pushed by a smooth tongued salesman without any practical experience.

Some 12 to 15 years ago I started a collection of old stuccos and plasters, getting complete information as to how old they were, nature of aggregate, etc., etc. I now have specimens of stuccos, mortars and plasters dating back over 100 years. Quite a number of these specimens were plastered on hand split lath, fastened with hand made nails. When these specimens were taken they were as good as the day they were put on. They are all examples of lime plaster, well sanded. Some of the specimens are as hard as concrete.

The organization with which I am connected, John H. McClatchy of Philadelphia, has always been interested in giving the people the most satisfactory home that can be built for the price involved. This has, of course, necessitated considerable experimental work on our part in an endeavor to determine what materials were most suitable from the economical point of view, as well as the standpoint of durability. For stucco, plaster and mortar we have confirmed the fact that lime was the most satisfactory. In addition we have found that this material also served a useful purpose in precast work, and have made use of it accordingly.

Some six years ago the writer was working with various concrete products. About that time we had considerable trouble with the stucco then being applied by various contractors. There seemed to be some difficulty in securing uniform and satisfactory results. It occurred to us that perhaps we could solve the problem by using a mortar mixer and deliver the stucco to the job ready-mixed. We tried it, and the indications were favorable. However, the mix then used did not seem to us to be the most suitable and we began to study the problem more intensively. While this study was under way with stucco we commenced to have some difficulty with plastering, which was then done by sub-contractors, and it also seemed a good plan to consider the problem of masons mortar. The problem grew rapidly once we started.

We tried practically every plastering material that was available. Some were hard to work but set quickly. Some made a very easy working mix, but cut down the strength. Others gave high strength, but were hard to handle. We finally adopted lime and since then we have had practically no difficulty in securing satisfactory and durable construction.

We decided to build a central mixing plant, and had to do it in a hurry, for the jobs were waiting for material. This was done. We installed a slaking system, consisting of a large slaking box about 30 feet long, 6 feet wide and 2 feet deep, in which a man can run off 120 bushels of lime per day without trouble. On the job we found that about 60 bushels was an average good day's work. With the large box we have our water readily available, four 1½-inch streams discharging into the box as needed. The lime is delivered close to the box so that the slaker can shovel it in without much effort and can handle the job without lost motion. From the box the lime is run through a screen into storage vats

* Presented before the Eighth Annual Convention, National Lime Association, June 8-11, 1926, French Lick, Indiana.

where it is allowed to stand until cold, a matter of three weeks under normal conditions. These vats are about 30 feet long, 5 feet 6 inches deep and 5 feet wide. After the lime is run off it is allowed to stand for two days and the water which rises is then pumped to a storage tank, to be used in slaking another batch of lime. The putty then lies for the balance of the three weeks without being disturbed.

From the vats the putty is moved to the mixers by wheelbarrow. We have found by experience that it does not pay us to try and pump the lime from the vats to the mixers. Two Blystone mixers are used, each arranged for independent operation, with separate sand storage bins, etc. The mixer is fully charged with sand while in motion, the necessary amount of properly picked hair and fibre put in, the lime added, and the whole mass is then thoroughly mixed for about 3 minutes. The mixer then turns over and discharges into a waiting truck below. Four men operate the mortar plant, taking care of the slacking, moving of the lime to the mixers, sand storage, the mixing, hair and fibre picking and general work with a production of about 65 tons per day. This plant runs steadily every working day in the year. In fact, it is the only way that we can handle plaster and stucco jobs during the cold months. Construction naturally slows down to some extent, but even during the coldest weather we slake at least 60 bushels of lime every day. In fact, three years ago we lost only two days in zero weather, about one week was lost the year before last, and about the same time was lost last winter. We tried mixing on the job, but that did not work, and since we have been using the mixing plant everything has been much more satisfactory. We do not have trouble with waste or frozen plaster and we find that the work goes faster on the job. During the warm months we slake on an average of 150 bushels of lime per day so you see that our central mixing plant is a busy place at all seasons of the year.

Within a 5 mile radius of our plant we find that we can get ready-mixed plaster, and stucco on the job at a lower cost than can possibly be secured by even the most efficient field operation. We have far less waste and are assured of a uniform mortar at all times. It also increases the efficiency of the plasterers, for they know exactly what kind of material to expect, and work steadily, not having to bother about retempering or other delays which are frequently encountered when field mixing is practiced.

For delivering mortar we use International trucks, with one yard special bodies designed to dump into mortar boxes. We found that puncture proof tires, either of the solid or perforated type, are absolutely necessary, for tire trouble must be eliminated.

The way to make the best stucco was our first problem after the central mixing plant had been developed. This involved a careful study of the materials available. We studied lime, cement, sand and special aggregates. We finally developed a specification which we thought was suitable and then the problem was to get sand which closely approached this specification, for it was, of course, impossible to get sand commercially that would meet every requirement and still be cheap enough to use. We have standardized on a local sand with satisfactory results. This we use for the first two coats. We purchase in large quantities and are able to get an attractive price because the dealer knows exactly how long it will take his trucks to bring a load to the plant and also that our storage is large enough to take sand at his convenience.

The common sand we use is the finer material from concrete sand, the largest particles passing a number 8 screen and about 5 per cent passing a 200-mesh screen. The approach to our plant is paved and this eliminates the danger of trucks getting stuck in the mud, which is a serious item in trucking costs. Naturally we benefit by this facility, which is not usually the case with sand deliveries direct to a housing operation.

Sand is used only in the scratch and brown coats of our stucco, as we find that a coarser material works better with the type of finish we use. For this finish coat we prepare our own aggregate by crushing Cape May pebbles, or "pea grit." These pebbles are extremely hard and break up very well in a roll crusher, set to ¼ inch. There is a surprisingly small percentage of fines in this crushing and we have found by experience that screening is not necessary. This aggregate is very light in color and blends in

with any of the colors we use to good advantage.

We always secure our stocks in large quantities. This applies to all materials used, and as a result we get a good choice. This is particularly true with respect to hair and fibre, which are important in both plaster and stucco. We use equal parts of hair and fibre, the hair running from ½ to 1½ inches long and the fibre from 2 to 3 inches in length. Both materials go through a picker which fluffs them up ready for use. The picking is done by the mixer operator in his spare time.

All our plant proportions are by volume, as we have found that method of proportioning to be the most satisfactory. For the scratch coat stucco, we use a mix of about 2½ cubic feet of lime putty, 1 sack of Portland cement and 8 cubic feet of sand, to which we add 1½ pounds of hair and 1½ pounds of fibre. For the brown coat, which must be leaner, we use 2 cubic feet of lime putty, 1 sack of portland cement, and 8 cubic feet of sand. We find that in stucco it is not necessary to add any hair or fibre to the brown coat. In the finish coat we use 2 cubic feet of lime putty, 1 sack of portland cement and 8 cubic feet of crushed aggregate, without any hair or fibre.

A great deal of our stucco is applied over frame construction. On this type of house the frame is first covered with a layer of rubberoid, which we have found to be better than the ordinary building paper which is usually applied. Over this, galvanized wire is applied, furred out with wood lath on 12 inch centers. This insures a good thick coat of stucco, protecting the metal and eliminating cracks.

When we apply the stucco to concrete blocks it is highly important that the surface be wet first. After the scratch coat is applied we let it harden and dry for at least two days. If the scratch coat has been put on from construction, it is not necessary to dampen it before browning, but if it is on blocks, we find that it must be wet before the brown coat can be applied. This is because of the high absorption of the blocks.

The brown coat is applied to bring the surface out and even up the job. Before it has hardened, the finish coat is put on and worked into the brown. The finish most commonly used is a rough drag or scrape finish, as will be seen from the pictures, made by dragging the edge of the trowel over the surface. This work is done by the average plasterer without special training and gives very satisfactory results. We use cream, salmon, buff and grey tints in addition to the pure white. For the tints, mineral colors (oxides) are used, and for the pure white we use white cement instead of the grey cement ordinarily used.

The story of our plaster is quite similar to that of the stucco, except that we use slightly different proportions. Both metal and wood lath are used in our houses, the wood usually on the side walls and the metal on the ceilings. We have found it more economical to use a stiff lath—about 3.2 pounds per square yard—for the ceiling work, than to use the lighter grades. The reason is that there is less dropping and the men can work faster over a stiff surface. We have never had any trouble from plaster falling from either ceilings or walls.

For the scratch coat our mix is: 8 cubic feet of sand, ½ sack of portland cement and 4 cubic feet of lime putty and 3 pounds of hair and fibre, or a 1:2 mix.

The brown coat mix is: 8 cubic feet of sand, ½ sack of portland cement, and 2 cubic feet of lime putty and 1 pound of hair, or a 1:3.2 mix.

All our plaster work is doubled-up, or laid-off. That is, the brown coat is applied immediately after the scratch coat, thus ensuring an absolute bond between the two coats. We use a different mix for the two coats in order to reduce cracking and also to reduce the cost, but feel that a rather rich scratch coat is necessary, for upon it depends the integrity of the whole job. However, we do not find it necessary to get a special class of plasterers for this work, as we find that with lime mortar such as we supply to the plasterers there is no difficulty in obtaining good work, with the proper supervision. Their work as well as the material is uniform, and we find the same kind of plastering is done in the afternoon as in the morning. The mortar is always smooth, uniform and easy working and does not "pull their arms out." Every man covers a good yardage each day and we use a high percentage of apprentices. We obtain good plastering, and we are not troubled with falling ceilings, bulged side walls, or cracking.

We have had complaints at various times from some plasterers about the

use of machine made mortar. Some of them claim that they get a better and harder wall when the mortar is prepared on the job, but we have found that the machine made mortar is more satisfactory, both as regards durability and economy. It has been necessary to clean house a couple of times with both the plasterers and the hod carriers, but we have never experienced any difficulty in getting men to take the place of those who were discharged, as we give them steady work practically the whole year round. At one time we discharged 65 plasterers and filled their places within a few days.

When one considers that for the past four years Mr. McClatchy has been building about two houses every working day or between 600 and 800 per year—you will realize the problem that must be met in supplying the men with mortar for plaster and stucco. At times well over a hundred plasterers are on the various jobs, and never less than forty plasterers are working.

At first we supplied the brick and stone masons with their mortar, but we found that it was more satisfactory for our central plant to just supply the plasterers, where a high grade mortar is absolutely essential, than to attempt to also make the leaner mortar used by the masons. In an emergency, of course, where a small amount is required, we send mortar out to any part of the job, made as needed for the work under way.

We have found that lime stucco and lime plaster are very adaptable. They are easily prepared, easily worked, easily colored. Any desired texture may be secured without difficulty, ranging from the smooth finish to special trowel finishes and color blends. The Home Electric, which we built for the Sesqui-Centennial at Philadelphia is a lime stucco job, finished with three color Spanish style stucco. The only change in our specification was in the colors used and in the special trowel work on the surface. Those of you who plan to be in Philadelphia can see thousands of lime jobs in good condition.

Charles Melvin who was connected with the Fairbanks Steam Shovel Company for twenty-four years has been retained by the Osgood Company and placed in charge of the department for handling service and repair parts on Fairbanks machines.

New Heil Building

Twenty-five years ago, May 1st, the Heil Co. came into being in a little frame structure on Fourth and Poplar streets, Milwaukee. Today the company has just completed over a quarter million dollar building program which includes a new office, power house and shops.

The power house, garage and main factory addition were completed in the winter. The office building was completed the early part of this spring. There is now under construction a new hoist shop 300 feet long x 100 feet wide to be made of red brick, saw-tooth construction, which will be completed before fall.

The office is a handsome edifice built of red brick, Colonial architecture, three stories high, 40 feet wide x 120 feet long with a large wing.

The property of the company extends from Kilbourn Road (22nd avenue) to 27th avenue, and from Dakota to Montana avenues with additional property at the north of Montana avenue. The plant itself covers more than 200,000 square feet of ground floor space.

Modern machinery has been installed for the manufacture of steel dump bodies, welded compartment and storage tanks and hydraulic hoists. Heil dump bodies, hoists and trucks are used in every state of the union and in twenty-five foreign countries.

There has been a marked increase in the demand for Heil bodies and hoists for use in road building, coal hauling and excavating during the last few years. The president of the Heil Company is Clement C. Smith and the vice-president and general manager is Julius P. Heil.

New Lidgerwood Bulletin

A pamphlet on "Cableways for Coal Storage and Reclaiming" has just been issued by the manufacturers of Lidgerwood traveling cableways. This cannot fail to interest not only operators with coal storage problems but executives of the large number of plants in the non-metallic field where storage and reclamation are serious questions.

The pamphlet gives graphic and detailed information as to just how two large concerns solved their coal problem, together with cost figures.

A Labor Saving Sand and Gravel Plant

ONE of the most interesting of the long string of operations of the Neal Gravel Company is the plant opened June 1, last year, at Cayuga, Indiana. The layout has proved to be efficient as a saver of time and labor, a factor which has contributed materially to the success of the venture. The entire operation is electric, 300 h. p. being required for the job. This is distributed among five motors.

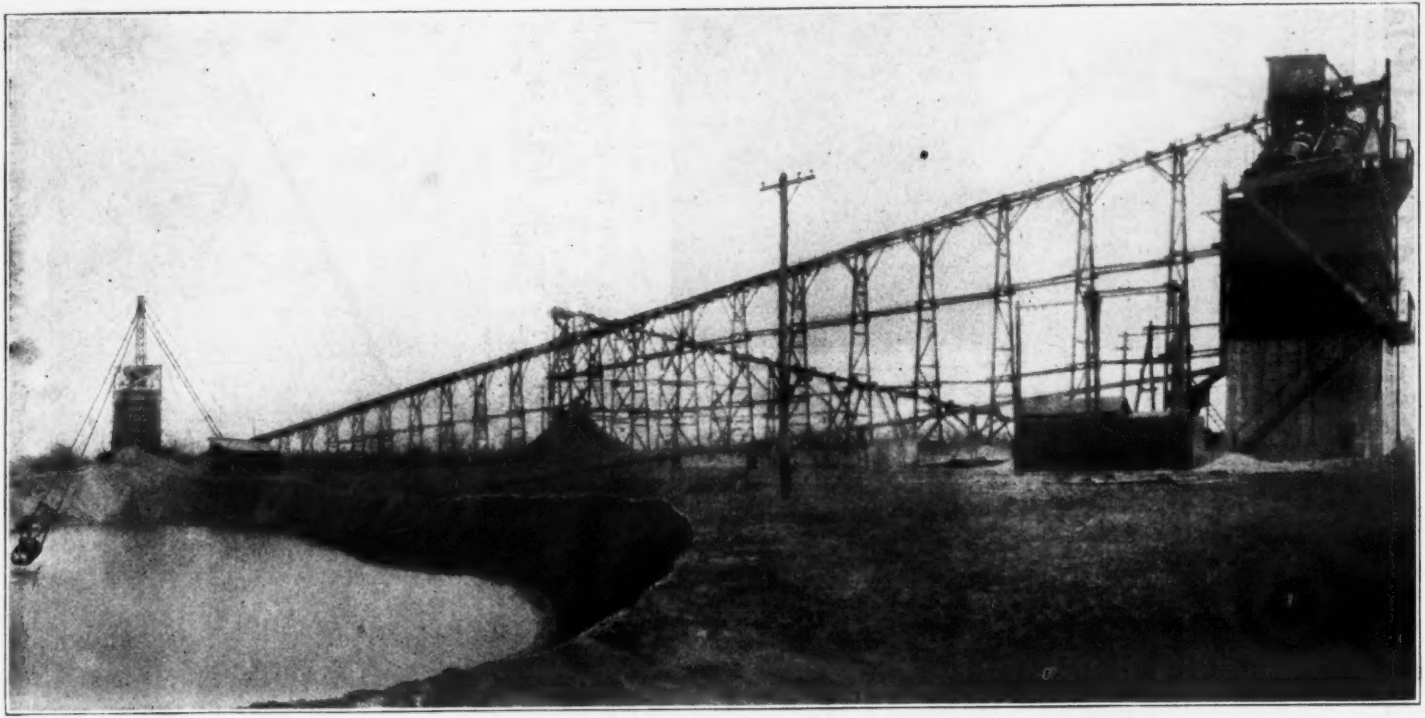
The deposit covers an area of fifty acres and has a depth of fifty to sixty feet. It is located near the Nickel Plate Railroad just east of Cayuga, Indiana. The quality of this deposit is said to be one of the best in the Wabash valley.

The company uses a Sauerman slackline cableway, operated by a Sauerman two-speed electric hoist, which delivers material to a field storage hopper located near the center of the property. This field hopper has a capacity of about six hundred cubic yards. The dragline is equipped with a two-yard bucket. The material is fed from this hopper by gravity onto a five hundred foot inclined belt conveyor that runs to the top of the washing plant. The advantage of this field hopper permits digging a very large acreage without moving any of the equipment. All the material within a fifteen hundred foot circle, except the ground on which the hopper and conveyor stands is accessible to the dragline. Still another advantage is that the dragline and the washing plant are two independent operations.

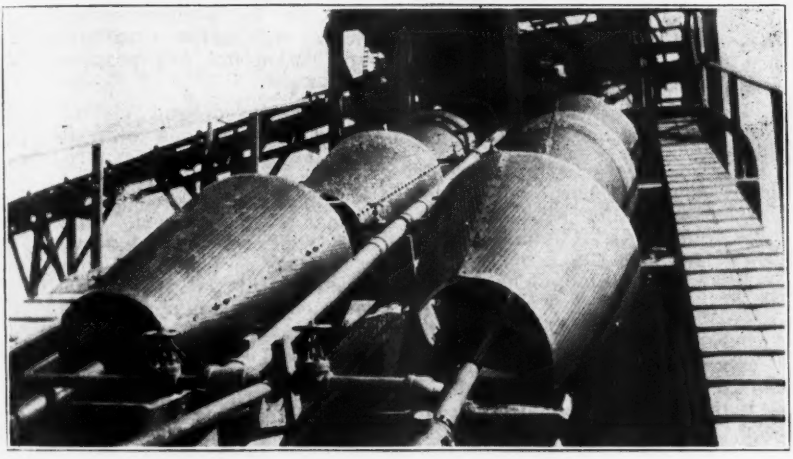
The Start of the Digging

The washing plant is equipped with eight revolving screens, which sep-

View of Storage Plant Taken Just After Completion



General View of Operation Showing Screening Plant, Conveying System and Pit



Above, the Bucket; Center, the Screens; Below, the Crew.

arate the material into four sizes: 2-inch, 1-inch, five-sixteenths-inch and three-thirty-seconds-inch. All oversize drops into the bin, where it is fed into a number 4 Austin crusher. It is then elevated back to the screens. The advantage of a bin for the oversize instead of going directly to the crusher is the crusher may be idle for days at a time while being repaired and the balance of the plant can be producing material. The sand is separated in two automatic settling tanks. They have a forty horse power American electric pump which furnishes about twelve hundred gallons of water per minute for the washing. The bin capacity is eight car loads. The total output for ten hours is from twenty-five to thirty cars of washed sand and gravel.

A crew of six to eight men is employed but in an emergency the plant can run with two or three men.

The water is pumped from the pond from which the gravel is taken. In starting they dug a pit with the dragline big enough to furnish water for starting.

A. H. Warnick is superintendent of the plant and had charge of its design and construction. He has been with the Neal Gravel Company for a number of years in this capacity.

The Neal Gravel Company was one of the first to produce washed sand and gravel and are today one of the largest producers. They have an annual capacity of over twenty-five thousand cars of washed material.

The main office of the concern is at Mattoon, Illinois. The officers of the company are H. E. Neal, president; B. E. Neal, vice president; E. Guy Sutton, secretary-treasurer; J. P. Cantlon, manager of sales, and F. P. Steinberg, manager of operations.

In addition to the plant at Cayuga the Neal Gravel Company has plants at Wolcottville, Attica, Covington, Summit Grove, Indiana, and Palestine, Illinois.

Upham Resigns State Position

Charles M. Upham, business director of the American Road Builders Association, has resigned his position as State Highway Engineer of North Carolina. Mr. Upham will continue his connection with the road builders association and will continue as director of the Highway Research Board of the National Research Council and as Engineer-Manager of the Byrne Brothers Construction Company of Mexico.

Flory Hoist Bulletin

A new bulletin has just been issued describing the line of Flory hoists designed for operating slack line excavator plants. The machines are built for steam, gasoline, electric or belt power. The drums are a special mixture of cast iron accurately machined on the face, balanced and properly ribbed to withstand crushing strains.

The front drum is equipped with two band frictions and two sets of gearings for high and low speed. The low speed is used for the digging operation and the high for hauling the bucket. Speed changes can be made instantaneously without stopping the motor or engine. The rear drum is single speed and is equipped with the Flory asbestos cone type friction with screw thrust, non heating friction nut and positive release mechanism.

The improved band friction used on these machines has been developed after many years of experience. It consists of a simple system of levers actuating the rocker shaft to which the bands are fastened. The fulcrum of the bell crank rocker arm is placed on the spoke below the rim of the wheel to shorten the travel of the sleeve of the drum shaft. This reduces the distance between the gear and the bearing to a minimum. The band is of two pieces each supported at one end by heavy pins and the other end fastened to the rocker shaft. In case of accident to either half band the hoist can be operated with half the load at normal speed. The operation consists of moving a sleeve along the drum shaft by either hand or mechanical power.

The improved asbestos cone friction consists of an asbestos cone titted and secured to a projecting rim of the gear wheel. A rim is cast on the gear flange with a bevel on the inner side corresponding with the asbestos cone with which it engages when thrown in contact.

The Robert W. Hunt & Company, Ltd., Montreal, announces that it has a completely equipped cement testing laboratory in connection with its office in the Harbor Administration Building, Toronto. J. F. Keane is the Toronto manager.

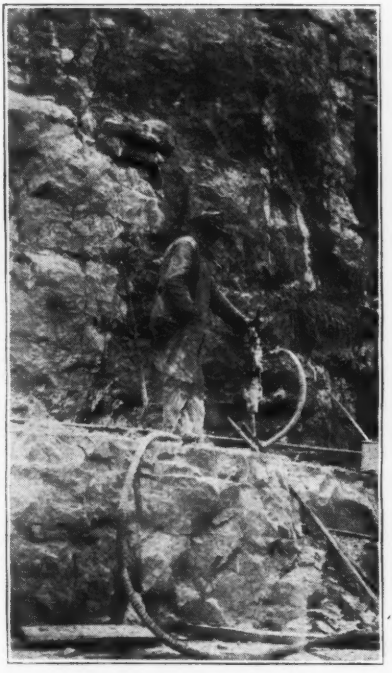
The Tail Is Wagging the Dog in This Lime Plant

By E. D. Roberts

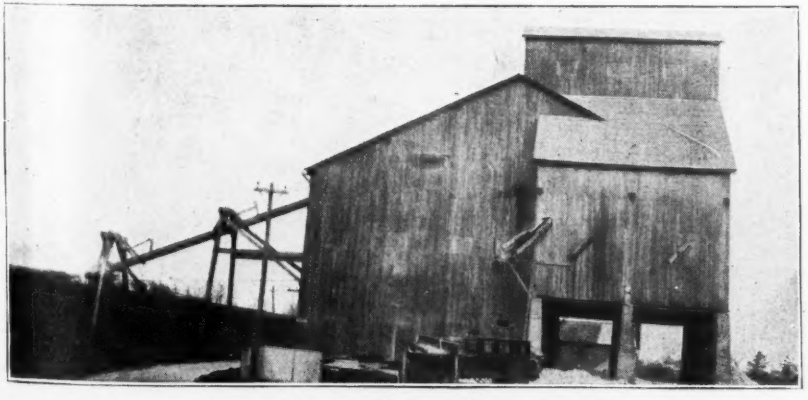
THE old saying, "the tail is wagging the dog," aptly applies to the situation in which the Falls Lime and Stone Company of Sheboygan Falls, Wisconsin, now finds itself. This is due to the change in demand for their products which now taxes to capacity the crusher plant originally installed to market the spalls produced in the quarrying of stone for their lime kiln.

Sheboygan Falls is a small manufacturing town of two thousand population located six miles from Sheboygan and two miles from Kohler. Sheboygan is the center of the enameling industry of the world. Kohler is an industrial city built up by the Kohler Enameling Company for the housing of their employees. These three towns have taken large quantities of paving and building materials.

Before going on with the description of this operation it is worth while to turn aside and discuss the industrial village of Kohler. There is nothing new in the idea of the industrial village, they have been tried and developed to a certain extent by operators in the non-metallic industries. Frequently, however, the charge of paternalism is laid against the scheme. This cannot be justly charged against the activities of Kohler. No one is made to fit into a standardized wheel as one of many cogs, but individuality is encouraged. Its encouragement is a fixed policy of the company. Employees can obtain the financial assistance to buy a lot in his own name and build a home for him-



View of Drilling Operations

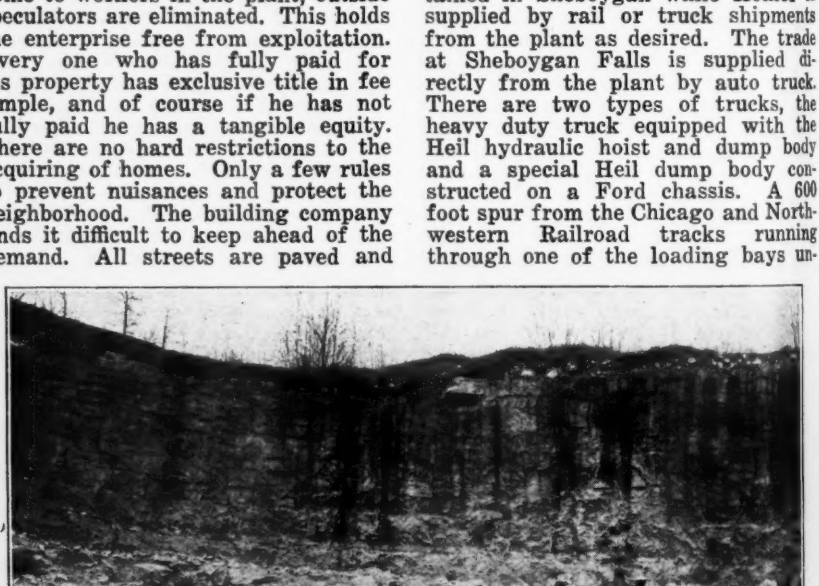


Storage Bins Showing Loading Facilities

self and his family through a building and loan association. He thus becomes an integral part of the community's social and civil life. The Kohler Improvement Company erects houses for employes purchased upon designs prepared by able architects. These houses are sold at a low cost to members of the Kohler Company organization. The improvement company also landscape each plot of ground, plant trees, shrubs, etc., and tries to avoid monotony in buildings. A splendid ten-room school building is located in the heart of the village and provisions have been made for extension. The village is an incorporated municipality, governed by an elected president, clerk and village board. Recreation and amusement are provided through athletic clubs, concerts, lectures and similar organizations. A unique provision for workers who are without homes of their own is the American Club, a brick building devoted entirely to men of this class. By limiting ownership of home to workers in the plant, outside speculators are eliminated. This holds the enterprise free from exploitation. Every one who has fully paid for his property has exclusive title in fee simple, and of course if he has not fully paid he has a tangible equity. There are no hard restrictions to the acquiring of homes. Only a few rules to prevent nuisances and protect the neighborhood. The building company finds it difficult to keep ahead of the demand. All streets are paved and public utilities are installed and the upkeep provided for by the village and not at the expense of the company. The village has a population of about 1,500. There are over 200 occupied houses. The Kohler organization comprises about 3,000 persons.

To create the civic life of the community and the ideals of the founder, a day each spring is set aside for Americanization. Evening school from October to April under the board of education prepare them for citizenship. The practical result of this nationalization requirement is seen in the complete assimilation of the foreign born and the withholding of the promotion to situations of responsibility to every foreigner who is not thoroughly Americanized. The American Club serves nearly 2,000 meals each day at actual cost. It provides recreation rooms, library, baths, etc.

A large part of the crushed rock for which comes from the Falls Lime and Stone Company's plant at Sheboygan Falls. A distributing yard is maintained in Sheboygan while Kohler is supplied by rail or truck shipments from the plant as desired. The trade at Sheboygan Falls is supplied directly from the plant by auto truck. There are two types of trucks, the heavy duty truck equipped with the Heil hydraulic hoist and dump body and a special Heil dump body constructed on a Ford chassis. A 600 foot spur from the Chicago and Northwestern Railroad tracks running through one of the loading bays un-



One of the Quarry Faces

der the storage bins provides for rail shipments.

There is one lime kiln of the continuous type built on the side of the hill with a road leading to the top. The lime rock is loaded in center-dump grading wagons and hauled from the quarry by horses to the top of the kiln where the load is dumped into the kiln. As the demand for crushed rock for concrete increased it was decided to install a crusher plant and market the waste. A railroad track ran through the property, cutting it in two, thus limiting the available sites for the crusher plant. The best site available did not allow of the usual inclined track, so a special hoisting arrangement was installed. This allows quarrying to any depth without the extension of a long incline, and has proven satisfactory.

Ingersoll-Rand jackhammer drills provide the holes for shooting loose the rock which is done with Hercules 40 per cent gelatin. The tracks radiate from a common point near the hoist to the different faces being worked. Quarrying is done by a system of rotation, that is drilling and shooting at one face while the rock is being loaded at another so that the two operations will not interfere with each other. A Cameron centrifugal pump operated by a 7½ h. p. motor keeps the quarry dry.

The cars are of special type. A frame work or chassis on wheels supports a skip which rests on the chassis. There are three lugs on the sides of the skips over which are looped chains from a ring fastened to a large single block. There are two other projections which are provided to dump the skip.

When the chains have been fastened to the lugs, the loader pulls a cord, ringing a bell which signals the hoist operator that the load is in position for raising. The load is then raised vertically until the block is pulled against another block fastened to a trolley which travels on an inclined track up into the crusher house. When the block holding the skip engages the other block, the trolley starts up the incline at the same time carrying the skip. At the proper point a beam has been placed across the path of the trolley so that it will engage the projections on the skip dump, thus holding part of the skip which is suspended by the further travel of the trolley. After the load has been dumped, the hoist allows the trolley to run back down the incline to the point from which it started and the weight of the skip overhauls the cable and the skip returns to the car chassis. Complete control of the hoisting operation is maintained by a Power and Mining Machinery Company (now Allis-Chalmers Company) hoist, direct-connected by a series of reduction gears to an Allis-Chalmers electric motor.

The rock that has been dumped from the skip falls directly into a number 5 Gates gyratory crusher set to crush to a 2-inch maximum. Discharged from the crusher, the rock enters the buckets of an inclined 8 x

View of Quarry From the Hoist

18 inch bucket elevator which lifts the rock to the top of the crusher house and feeds it to the large rotary screen which separates the material into four commercial sizes, namely: 2 to 1 inch, ½ to 1 inch, chips and dust. The separated material is chuted directly into the bin below. There are two bins for each grade, one over each loading bay. These bays are arranged so that cars for rail shipment may be spotted in one bay for loading while truck shipments may be made from both bays.

The crusher machinery, elevator, and rotary screen are all operated from one Allis-Chalmers motor.

Additional storage of crushed materials is provided by chutes leading from the rotary screen to points over a paved area outside of and adjacent to the crusher house.

The remaining equipment of the plant consists of a Sullivan air compressor operated by a 35 h. p. Allis-Chalmers motor.

The officers of the Falls Lime and Stone Company are: William F. Schissler, president; William E. Hildebrand, vice president; William Hildebrand, jr., secretary; Louis Hildebrand, treasurer. The address of the company is Sheboygan Falls, Wis.

Use of Wire Saw in Slate Quarrying

A great need in the slate industry is the elimination of quarry waste, which now varies from nine-tenths to fifteen-sixteenths of gross production. Present methods of cutting, wedging and blasting slate are responsible for much of the waste. If the wire saw could be operated successfully a great saving could be accomplished. The Bureau of Mines is preparing to run a series of tests with the wire saw in Pennsylvania slate quarries. The work will be conducted under the direction of Dr. Oliver Bowles, superintendent of the New Brunswick, N. J., experiment station of the Bureau.

Mining and Milling of Mica

The constant demand for information on mica, and numerous new developments in the preparation and utilization of its material, have justified a broad study, and preparation of a report by the Bureau of Mines, Department of Commerce, covering all technical phases of the industry. This study has been undertaken by W. M. Myers, associate mineral technologist, attached to the Nonmetallic Minerals Station, New Brunswick, N. J.

Acme Magnetic Pulley

In its simplest form the magnetic pulley is used as the head pulley on a conveyor belt upon which is conveyed the material from which tramp iron must be extracted. The magnetic pull set up by the pulley reaches out through the belt and attracts the iron to it.

The non-magnetic material will be discharged in the usual manner on reaching the end of the belt, while the magnetic tramp iron will cling to the belt as long as it follows the pulley, thus in turn following it around until, as the belt breaks away from the arc of the pulley, the magnetic pull is broken and the iron lets go to drop in a convenient container.

Variations of this method are sometimes necessary because of plant layout; extremely heavy loads being conveyed, and the desirability of having the recovered iron as clean as possible.

To fill these conditions it is feasible to use a magnetic pulley with a short endless belt and an idler pulley. Here the iron is lifted and the belt carries it away to a receptacle.

This arrangement is advantageous in the case of a long belt requiring a large diameter head pulley as it allows the use of a more economical magnetic pulley than would otherwise be possible.

The Acme Magnetic Pulley body is supported from the shaft by means of a webbed centrally placed spider with a hub. The greatest strain always comes at the center and the support thus placed functions correctly. Not only that, but this construction permits of an unobstructed opening through the interior of the pulley, thus allowing a great volume of air to pass through in a spiral manner.

The spokes are so shaped that they propel this air through the interior cavity, acting like the blades of a fan.

The central hub is firmly keyed upon the shaft, and the recessed set collars prevent slippage.

All parts of the magnet body are smoothly machined and the coil cavities are then coated with five layers of insulating enamel of high dielectric qualities. Mica and asbestos insulation is then applied. A thoroughly insulated coil cavity is thus insured. Lead wires from the coils pass through mica bushings.